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Notice to Authors

By action of the Board of Directors at our Cincinnati Meeting, due to the increased cost of cuts, it was decided to limit the funds in the budget available for this item to the Journal only and that all authors submitting material accompanied by pictures (or charts or tables so constructed that they must be made into cut form) for publication in the Research Quarterly, will be asked to incur the expense of having these cuts made. This policy is effective beginning with the October, 1943, issue of the Quarterly. The Association regrets taking this action but war restrictions on metal and a limited budget make this policy necessary.

Membership Plans

At the present time individuals or organizations wishing to join the A.A.H.P.E.R. may do so during any month in the year. This means that every month in the year addressograph plates must be cut, expiration notices must be sent, and files must be brought up to date. The present procedure is time consuming and costly.

In order to reduce the cost and increase efficiency in handling memberships, it has been decided that all memberships received after July, 1943, will be entered as beginning in one of three months; i. e., October, January, or April. Many of the present memberships begin in one of these three months. Under the new plan memberships would expire in September, December, or March. Adjustments will be made with persons whose present memberships are later transferred to begin in October, January, or April.

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A Critical Evaluation of the Effectiveness of the Teacher in the Physical Inspection of Public School Children

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INTRODUCTION

NEVER has the health, physical stamina, and mental stability of youth been of such great importance to the future of this country as in the present emergency. The American public wants more health education since it has increased consciousness of health as a positive asset.

The school is the most important agency for health education since its unique function is education. The public schools with one million teachers contacting thirty million children are in a strategic position to be a powerful force in preventive health measures.

The most important health knowledge for the teacher is that which is secured from direct observation of children in action. Physical inspections in the dynamic and behavioristic sense help provide data for teaching for health for guidance and protection. Such teaching must begin early and must be carried out where other subjects are taught. It must be done by those who are trained in the approach to children's minds and who have frequent contact with them.

Physical inspections represent a procedure by which continuity and permanency of desirable health outcomes can be established. The attributes and unique position and function of the teacher for referral and general observation of improvement are the substance of educational material. Through physical inspections the teacher can capitalize on the stage already set for learning.

Few teachers have an adequate health education background. Many need in-service education which is effective only under certain conditions. Because of the difficulties which are encountered in such a program, it is important that persons be trained in health education before they enter the teaching field.

PURPOSES OF THE STUDY

The two purposes in making this study were:

1. The development of data that may be used as a basis for evalu-

An abstract of a thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Education of New York University, 1942.

ating the effectiveness of the teacher in physical inspection of public school children.

2. The formulation of recommendations consistent with the findings for guidance in establishing adequate teacher responsibility for physical inspections and their concomitant activities for public school children.

STATEMENT OF THE PROBLEM

The problem involved in the study was two-fold:

1. To formulate a measuring device (Physical Inspection Record Form) by which the teacher's effectiveness could be judged.

2. To determine the effectiveness of the classroom teacher in physical inspections by application of the measuring device to a sampling of public school children in grades one to twelve inclusive.

The term *effectiveness* as used in this study refers to the degree of efficiency and accuracy of the teacher in performing physical inspections. Efficiency refers to the degree to which the teacher is aware of or is able to observe and measure all the health deviations named by the physician. Accuracy refers to the degree to which the teacher can name cases which really have health deviations.

The *teacher* refers to the general and special classroom teacher.

The *physical inspection* is that part of the health examination which can be ethically and logically performed by the teacher. It is non-diagnostic. It is concerned with keen, brief, interested, and close though not exhaustive observation and objective measurement of health characteristics which can be seen or measured by some generally acceptable test. The findings are recorded as seen or measured.

METHOD AND PROCEDURES

Formulation of the Measuring Device

Types of information necessary were:

1. Current practice and opinion in representative schools as determined by a questionnaire.

2. Data to establish reliability of the questionnaire.

3. Opinions as expressed in the professional literature embodied in one hundred articles, books, and pamphlets critically selected after a review of 485 references.

4. Opinions of selected leaders as determined by interview and correspondence.

5. Opinion of an expert jury.

A questionnaire was mailed to 405 representative public schools in the United States and to twenty selected leaders. Replies were received from 40 per cent of the schools and adequate sampling and accuracy of the data were established.

Frequency tables listing criteria for selection of items for a

physical inspection were constructed. One hundred and ninety-eight tentative items for a physical inspection were compiled and classified in frequency tables. A refined list of ninety-one items which tentatively met the six criteria for selection was formulated. The refined list was submitted to an expert jury of twenty leaders with replies being received from thirteen medical and five educational authorities. Those items endorsed by two-thirds or more of the jury were retained in the final record form.

Determining Teacher Effectiveness

Necessary data were:

1. Health histories and parental consent of the subjects.

2. Physical inspections on 36 validated items on 96 male and female subjects in grades 1, 4, 7, 10, and 12. The subjects represented about one-seventh of the total enrollment in the University School, Indiana University, Bloomington, Indiana. Inspections were made by about one-half of the University School teachers (14) and fourteen physicians, each subject being given inspections by two teachers and two physicians for comparative purposes. Seven regular teachers in the elementary grades and the home-room teachers in the secondary grades inspected their own pupils. The other seven teachers were the regular and home-room teachers in the immediately preceding grades.

3. Personal data on teachers regarding length of experience, length of classroom acquaintance with subjects inspected, success rating by principal, and specific teaching responsibility for subjects inspected.

4. Re-inspections by four teachers on the thirty-six items with sixteen subjects for reliability measures. The factor of time in influencing reliability was adequately controlled by scheduling inspections for any subject on a rotation basis during the same clock hour.

The data on 13,824 distinct judgments were analyzed to show the objectivity, reliability, and validity of the teachers' judgments, item for item, using the physicians' judgments as the criterion.

Percentages of agreement for all items for defects, the normal conditions, and for total judgments were computed to determine efficiency and accuracy as component parts of effectiveness in the following combinations: all inspectors, teachers with physicians, physicians among themselves, and teachers among themselves. All judgments were considered to have equal weight. Correlations of agreement, critical ratios, other reliability measures, tables, and charts were used to present and clarify the analyses of data.

Agreement by the teacher on two-thirds or 66.7 per cent of the judgments of the physicians was considered as an arbitrary standard for satisfactory agreement.

BASIC FINDINGS AND CONCLUSIONS

Historical

The inadequate health condition of the school child, although difficult to determine objectively, is part of the startling health problem in the United States. There are mental, emotional, physiological, biological, economic, and general sociological implications for the care and education of children with health deviations. These have been sadly neglected by a complacent American public.

Leaders confirm the general conclusion that education will eventually accomplish more in public health than in any other single activity. School health service is now inadequate but indispensable in caring for the school child. Better internal management within the school health service is needed to make this service a culminating and cooperatve activity of health education, chiefly preventive in nature and reaching all pupils. In addition, school health service should result in a minimum loss of cases needing actual referral to medical personnel and removal of deviations. In the latter, the basis of preliminary selection of these children is of paramount importance. It must be done in an economical, accurate, educational, and practical manner.

Periodic examinations, regardless of their quality and frequency, are limited in finding children who need medical care and educational guidance. Diseases and defects do not wait for examinations. Day-by-day health supervision of pupils is fundamental. Health histories, which only the teacher can effectively provide, are prerequisites to accurate decisions. With the increasingly inadequate number of physicians and nurses, day-by-day supervision is even more important.

The wholesale character of the school health program, coupled with an increasingly inadequate number of trained physicians and nurses and with the demands for quantity rather than quality of service, seriously interferes with the potential education the medical advisor can and should render.

The relatively few periodic school health examinations have many acknowledged inadequacies. They should not be a substitute for continued health supervision but they should represent a limited group service only.

The teacher has participated relatively little in school health service. This seems illogical since the teacher is in a strategical position and has distinct attributes which make her wholehearted participation necessary and all the more likely to succeed.

Physical inspections used as a screening device are not examinations. They are used as an educational device with no medical diagnosis or treatment.

Favorable contributions by the classroom teacher are scarce

and are confined to certain geographical areas. Experimental studies are limited by numbers inspected, by application to all grade levels, by the physician's judgment only as the criterion, by the number of health items investigated, and by the interpretation of the specific task of the classroom teacher in the public schools.

There are educational, administrative, social, and economic aspects of the school health problem that make it desirable for the teacher to assume specific responsibility for physical inspections.

The Measuring Device

There are 36 validated items of a physical inspection* supported by present-day opinions, current practice, the professional literature, and by an expert jury.

The items which are ethically and logically within the specific province of the teacher to observe and measure should be embodied in the physical inspection.

Ninety-four per cent of the schools acknowledge the feasibility of developing a plan of physical inspections by the teacher, but only one-fourth express enthusiasm or acknowledged success of the plan. Only 3 per cent of the teachers oppose the plan.

Practice of the plan is much less than general acceptance. Opinion based on actual operation of the plan favored the expression of fewer limiting factors.

Lack of preparation and experience of the teacher are the two major limiting factors. Disapproval of the plan is usually associated with lack of time, training, or experience of the teacher, and the possibility of diagnosis by a non-medical person.

The term physical inspection implies inspections and not examinations. It is that part of the health examination that can ethically and logically be performed by the teacher. The technique is non-diagnostic and implies keen, brief, interested, and close though not exhaustive observation and objective measurement. The results are recorded as they are seen or measured. The teacher confines herself to differentiating betwen normal and abnormal conditions, and to referring the latter for medical care.

The term physical inspection implies screening as a forerunner of a health examination. It implies observation and measurement of the whole child and not his physical status only, informal as well as formal procedure, constant as well as periodic use, and positive rather than negative procedures. The purpose is for education or prevention rather than for medical care or treatment. The procedure is a scientific and accurate means to an end rather than to an isolated activity. It should result in effective referral and follow-up with economy of time and of personnel.

* Refer to Chart I which will be found at end of article.

The teacher acts as an ally and *liaison aide* between the child, the nurse, and the physician, and not as a substitute for the medical expert. Her function is to recognize signs and symptoms of "something" but never to define it.

Items of a physical inspection should be those which (1) require minimum knowledge on the part of the teacher; (2) are to be used as a basis for educational guidance; (3) indicate valid health status; (4) are non-diagnostic in nature; (5) are administratively feasible; and (6) require a minimum of time and effort of the teacher.

There is agreement on the general items of a physical inspection but very little agreement on specific items. Of 198 of the most common and recommended specific items only 34 met the standards for final selection. Two of these thirty-four involved two measurements each.

Experimental Determination of the Effectiveness of the Teacher in Conducting the Physical Inspection

The teacher made valid judgments on thirty-six validated items of the physical inspection. She did a commendable job in terms of efficiency (segregating deviations), accuracy (recognizing normal conditions), and effectiveness (making total judgments), regardless of the items inspected or the degree of discrimination requested. The errors in agreement were small and significant.

Using perfect agreement as the standard the mean percentage of agreement of the teachers with the physicians on both deviations and the normal conditions was above 66.7 for all of the thirty-six items except thirteen of the four-fold items. For the latter the figures were 48.5 or above but increased to 67.7 or above when a variation in one category in judgments was considered agreement.

The mean percentage of agreement of the teachers with the physicians on both deviations and normal cases was 75.1 for perfect agreement and 90.8 for a slight variation in judgments on the fifteen four-fold items . Ninety per cent of the teachers' judgments were corroborated by the physicians.

Teachers erred in their total judgments only 2.1 per cent (C.R. =2.6) for perfect agreement; only 1.9 per cent (C.R.=3.8) for slightly less discrimination on the four-fold items.

Low percentages of agreement were due to a lack of objectivity of the items. The objectivity coefficients for physicians and teachers on total judgments for thirty-six items were 77.2 (92.7) and 75.3 (90.3) respectively for perfect agreement and slightly less discrimination (C.R.=1.86 and 3.59 respectively). The objectivity coefficients of teachers on defects was significantly higher than those for physicians.

The reliability coefficient of the criterion was .98 or above regardless of the degree of discrimination requested.

Teachers erred only .2 per cent when only outstanding disagreements were considered.

Teachers did not tend to overlook defects but they slightly underestimated the normal child. The teachers' errors in judging the normal conditions were 7.2 per cent and 5.8 per cent for perfect agreement and slightly less discrimination (C.R.=29.15 and 26.48 respectively). These data suggest sensitiveness on the part of the teacher in regard to normal conditions. However, they also suggest a safety value in favor of the student.

Physicians agreed among themselves on eleven four-fold items on less than 67.7 per cent of the total judgments. When slightly less discrimination was requested the percentages of agreement increased to 87.5 or above.

The mean percentage of agreement of the teachers with the physicians on defects was 51.7 for perfect agreement and 68.0 for slightly less discrimination on the fifteen four-fold items. The figures for physicians were much lower (21.7 and 45.1). The differences were 30.0 and 22.9 (C.R.=12.77 and 7.17). Low objectivity resulted on all but two individual items.

Teachers were satisfactorily reliable in conducting physical inspections. The reliability coefficient of the teachers' inspections was 81.9 for perfect agreement and 96.0 for slightly less discrimination on the fifteen four-fold items. Variation in condition of the subjects (time factor) was adequately controlled.

The validity of individual teacher's judgments varied most on normal conditions, next for total judgments, and last for deviations. In effectiveness, the degree of discrimination was a greater factor in teachers' ranks than was the ability of individual teachers.

Years of school-teaching experience showed low rank-order correlations with the teachers' ranks in efficiency, accuracy, and effectiveness, and did not seem to be a significant factor in their ability.

Average length of classroom acquaintance of the teacher with the child showed low ranking order correlations with the teachers' ranks in efficiency, accuracy, and effectiveness, and was not a significant factor in their ability.

General success rating of the teachers by the principal showed low rank-order correlations with the teachers' ranks in efficiency, accuracy, and effectiveness, and was only a very slight factor in their ability.

Male teachers made significantly less errors on total judgments than the female teachers.

The efficiency, accuracy, and effectiveness of teachers varied little by grade level. First-grade teachers had the most difficulty and tenth-grade teachers the least difficulty in judging defects and normal

conditions and in making total judgments. The ranks of the teachers in other grades varied considerably with the degree of discrimination as shown by the low rank-order correlation of .30.

The regular teachers of the pupils inspected made significantly fewer errors than the others. The validity of the teacher's judgments was improved when she inspected her own pupils.

In proportion to the decreased discrimination requested, mean percentages of agreement increased for both physicians and teachers, and for total judgments, normal conditions, and deviations (especially for deviations). Highest percentages of agreement were secured for two-fold items, next for three-fold, and least for four-fold. Increased validity and objectivity of teachers' judgments and increased validity of the criterion were secured in eliminating three- and four-fold items, especially the latter.

Teachers reported an average of approximately 6 per cent more defects than the physicians. Teachers reported more defects than physicians on twenty-eight of thirty-two items compared. Physicians and teachers agreed on the increased percentages of defects in the first grade and the relative constant but decreased percentages for the remaining grades.

Inspections took little time since they averaged eleven minutes and eighteen seconds in length. For teachers the average time was eleven minutes and fifty-four seconds. For physicians it was ten minutes and forty-two seconds. The maximum and minimum times were approximately sixteen and eight minutes.

Difficulties encountered and expressed by teachers were few but were those which could be eliminated or could be met successfully by more experience and training of the teachers.

IMPLICATIONS AND APPLICATIONS

Since teachers in their strategical position and with their distinct attributes can validly, reliably, and objectively perform physical inspections, schools should foster physical inspections to protect the child and society, and to establish a basis for educational guidance. Physical inspections should become an educational force in public health and also should become a stimulating measure for curative medicine. They offer a satisfactory and practical solution of the school's physical defect and follow-up program. This is true especially in communities faced with limited finances and supply of nurses and physicians. Physical inspections emphasize redistribution of effort within the existing organization. They focus attention on the functional understanding of children most in need of medical and educational service. They provide more time for school health examinations, and they encourage better cooperation between school and community medical resources. Few schools can rightfully deny children the advantages of physical inspections.

Teachers have increased opportunities and responsibilities for this phase of health service. The less the frequency of the health examination the more important the function of the teacher becomes.

Children most in need of immediate as well as continuous observation, referral to medical personnel, and guidance can be accurately selected. They can be assured of better educational values in the health examination, and more cooperative and efficient follow-up. They can also be assured of better continuity, permanency, and measurement of desirable health outcomes.

School administrators should choose teachers who are trained to intelligently, sympathetically, and enthusiastically fit into the school's program of health education and health service. They should be assured of the teacher's preparation. They should promote teacher participation and continuity for physical inspections and provide for continued coaching and a plan of organization which encourages and supports this responsibility.

With the steady improvement in general teacher education and increased recognition of health outcomes, teacher education institutions should incorporate in their curriculums such specific courses as will lead to the acquiring of specific knowledge and techniques in observing and measuring health and behavior.

Supervision and periodic discussions should be utilized to increase the competency of the teacher.

Efforts should be directed to teaching the really significant signs and symptoms of normality, and then they should be directed to those observable signs and symptoms of abnormality.

Efforts should be directed toward making methods of inspection more objective.

Items should meet acceptable criteria and should be listed in such a way as to require the least discrimination in judgment. The use of two-fold items indicating the presence or absence of a condition, with descriptive findings and history indicating the degree of seriousness, are recommended for more efficient results.

Teachers should inspect their own pupils since they make the most valid judgments on their own pupils.

Efforts in physical inspections should be especially emphasized in the early elementary grades.

The legal, educational, and ethical considerations of physical inspections need to be followed strictly to make physical inspections of maximum value.

Teachers should observe history and all sorts of behaviors, should record them when they occur, and should learn when such signs and symptoms and behaviors suggest the need for medical care.

Cumulative records should be made an essential accompaniment of physical inspections.

Individual teachers who are adequately prepared should broaden their inspections as opportunity offers and keep accurate and carefully chosen data which can be published and studied.

Since the experimental phase of the study is limited in its application to only teachers in a laboratory school, a greater sampling of teachers in all types of schools should be studied.

Just as many of the weaknesses of health service are closely related to the prerequisites of minimum cost, time, equipment, and personnel, so will many of the advantages of physical inspections emerge as a result of these same factors.

(Chart I)

PHYSICAL INSPECTION RECORD (Front Side)

Name of Pupil: .....
Last name First Middle
Address ..... Sex—M F
Name of Parent or Guardian .....
Date of Birth Mo. ..... da. ..... yr. 19.....
Name of Family Physician .....

NUTRITION AND GROWTH
1. Body Type (General Estimate)
—*Slender, Medium, Heavy*
2. Present Height *inches*
3. Present Weight *pounds*

EYES AND VISUAL ACUITY
4. Snellen Test — R-20/ L-20/
5. Alignment — *Normal, Crossed*
6. Conjunctiva — *Normal, Pale, Inflamed*
7. *Lids — Normal, Encrusted, Swollen, Inflamed, Styes*

EARS AND HEARING ACUITY
8. Watch Tick Test — *R L*
9. Discharge — *Yes, No*

TEETH
10. Decay or Carious — 0, 1, 2, 3
11. Cleanliness — *Excellent, Good, Fair, Poor*

TONGUE
12. Coated — *Yes, No*

NOSE
13. Breathing — *Free, Apparent obstruction*
14. Nasal Discharge — *Yes — Acute, Chronic, No*

HAIR AND SCALP
15. Cleanliness — *Excellent, Good, Fair, Poor*
16. Lustre — *Excellent, Good, Fair, Poor*
17. Pediculosis (Vermin or Lice) — *Yes, No*
18. Inflammation (Scalp) — *Yes, No*

SKIN
19. Eruption — *Yes, No. (Describe if yes)*
20. Vaccination Scar — *Yes, No*

GENERAL CLEANLINESS
21. *Excellent, Good, Fair, Poor*

Code: 0, normal; 1, slight; 2, moderate; 3, marked.

POSTURE AND GAIT (Body Mechanics)

22. General Estimate (combined standing, sitting and walking) — *Excellent, Good, Fair, Poor*
23. Round Shoulders — 0, 1, 2, 3
24. Unequal height of shoulders — *Yes, No*
25. Shoes (General Size, Shape, and Condition) — *Excellent, Good, Fair, Poor*

SPEECH

26. Lisping — *Yes, No*
27. Huskiness — *Yes, No*
28. Stammering or Stuttering — *Yes, No*

GENERAL NERVOUS CONDITION

29. Involuntary Twitchings (Spasm, Tic or Tremor) — *Yes, No*
30. Nervous Habits — *Nailbiting, Other mannerisms (Describe)*
31. Emotional Type — *Depressed, Normal, Excitable*

ESTIMATE OF SOCIAL ADJUSTMENT

32. *Excellent, Good, Fair, Poor*

ESTIMATE OF GENERAL BEHAVIOR

33. *Excellent, Good, Fair, Poor*

GENERAL PHYSICAL APPEARANCE

34. Expression of General Vigor and Vitality — *Excellent, Good, Fair, Poor*

Inspected or examined by.....
Length of classroom acquaintance with child..... *semesters*
Evidences of any abnormality not listed:
Remarks of Inspector on Pupil's Health Status and Behavior Symptoms:
Summary of deviations:
Recommendations of Physician:
Parent Present at Inspection — *Yes, No*
Parents Informed — *Date, By Mail, Personal Visit*
Results:

DISEASE HISTORY (Back Side)

Please Check	*Yes*	*No*	*Year of Sickness*
Measles	.....	.....	.....
Scarlet Fever	.....	.....	.....
Diphtheria	.....	.....	.....
Whooping Cough	.....	.....	.....
Pneumonia	.....	.....	.....
Chicken Pox	.....	.....	.....
Small Pox	.....	.....	.....
Mumps	.....	.....	.....
Rheumatism	.....	.....	.....
Tonsilitis	.....	.....	.....
Tuberculosis	.....	.....	.....

HISTORY OF IMMUNIZATION AND VACCINATION

Diphtheria
Immunized — *Yes, No*
Shick Test — *Positive, Negative*
Small Pox Vaccination — *Yes, No*
Typhoid — *Yes, No*
Tuberculin Skin Test — *Positive, Negative*

CAUSES FOR MOST FREQUENT ABSENCES FOR ILLNESS
(Please Check)

Colds
Sore Throat
Stomach Upset
Others (Specify)

NURSE'S REPORT

(Space for nurse's report is indicated on card.)

SUMMARY OF PERCENTAGES ON WHICH VARIOUS COMBINATIONS OF THE INSPECTORS AGREED IN MAKING JUDGMENTS ON ALL ITEMS OF THE PHYSICAL INSPECTION USING PERFECT AGREEMENT AS STANDARD.

Note: The figures in parentheses are the results when a variation of only one category in judgments on the 15 four-fold items was considered agreement.

28 Inspectors: 14 Phys ; 14 Teachers
Grades: 1, 4, 7, 10, 12
96 Cases: 52 Boys; 44 Girls
384 Inspections on 36 Items for 13,824 Judgments

Dev. - Deviations
Agr. - Agreement
Per. - Percentage
Nor. - Normal

Percentages of Agreement

Item***		Physicians Among Themselves		Rank		Teachers With Physicians		Rank		Teachers Among Themselves		Rank		All Inspectors		Rank	
1	Dev	28.6		5	(18)	65.3		5	(17)	70.5		11	(24)	61.7		4	(18)
	Nor	100		10	(17.5)	90.0		12	(27)	78.9		14	(29)	99.8		15	(28)
	Dev&Nor	71.9		22	(35)	77.1		19	(34)	75.0		18.5	(51.5)	76.0		19	(34)
2	Dev	Not included in this summary due to characteristic of the item.															
	Nor	Not included in this summary due to characteristic of the item.															
	Dev&Nor	90.6		11.5	(25)	91.9		9	(20)	96.9		6.5	(11.5)	92.5		9	(20)
3	Dev	Not included in this summary due to characteristic of the item.															
	Nor	Not included in this summary due to characteristic of the item.															
	Dev&Nor	97.5		15	(29.5)	89.4		11	(25)	90.6		11.5	(23)	89.4		12	(26)
4A	Dev	83.3	(88.7)	6	(8.5)	80.4	(85.4)	6	(4)	88.3	(100)	7.5	(8)	89.7	(84.7)	8	(4)
	Nor	81.0	(100)	21	(17.5)	89.1	(90.4)	21	(4)	77.4	(100)	17	(2)	72.5	(90.6)	21	(5.5)
	Dev&Nor	75.0	(95.8)	30	(14)	88.0	(97.7)	22	(7)	78.1	(100)	15.5	(2)	70.8	(97.7)	22	(7)
4L	Dev	15.4	(61.5)	11	(12)	48.2	(80.0)	19	(10)	61.5	(82.5)	17	(15)	43.8	(79.5)	17	(10)
	Nor	81.9	(100)	20	(17.5)	75.9	(99.7)	19	(3)	78.3	(98.8)	18	(5)	77.3	(99.8)	20	(3.5)
	Dev&Nor	72.9	(94.8)	31	(18)	71.9	(97.1)	20	(.1)	76.0	(97.9)	17	(7.5)	72.7	(98.9)	20	(11)
5	Dev	0		25.5	(29.5)	50.0		13.5	(25.5)	100		5	(6)	50.0		9.5	(22.5)
	Nor	100		10	(17.5)	93.5		10	(23)	98.9		3.5	(7)	95.5		10	(23)
	Dev&Nor	97.9		6	(10.5)	98.5		4	(4)	99.0		3.5	(5)	98.5		4	(5)
6	Dev	7.2		17	(25)	44.7		21	(51)	78.6		9	(22)	44.1		15	(28)
	Nor	100		10	(17.5)	94.5		9	(20.5)	89.0		11	(26)	94.5		9	(21)
	Dev&Nor	88.5		16	(32)	97.2		13	(27)	97.5		13	(26)	97.2		13.5	(28)
7	Dev	0		25.5	(29.5)	42.5		22	(52)	70.0		12	(25)	40.0		21	(52)
	Nor	100		10	(17.5)	96.5		6	(15)	94.2		9	(18)	97.7		6	(13)
	Dev&Nor	89.6		13.5	(27.5)	90.9		10	(22)	91.7		9.5	(20)	90.6		10	(22)
8A	Dev	9.1	(45.5)	18	(16)	34.0	(63.6)	30	(18)	55.5	(81.1)	22	(21)	33.4	(63.5)	28.5	(17)
	Nor	71.4	(100)	23.5	(17.5)	68.5	(95.6)	22	(2)	84.9	(90.5)	25	(25)	68.4	(94.1)	22	(22)
	Dev&Nor	54.2	(97.5)	30	(29.5)	59.7	(88.7)	26	(18)	68.5	(88.5)	26.5	(28.5)	59.2	(97.2)	26	(28)
8L	Dev	17.8	(47.1)	20	(16)	58.2	(85.2)	28	(19)	61.3	(89.2)	28	(17)	56.8	(84.7)	28	(14)
	Nor	60.8	(100)	27	(17.5)	87.7	(98.2)	23	(16)	80.6	(91.1)	19	(22)	86.9	(96.0)	23	(16.5)
	Dev&Nor	55.1	(90.6)	31.5	(25)	82.5	(90.4)	24	(23)	64.8	(90.0)	24	(23)	82.5	(90.4)	23	(23)
9	Dev	0		25.5	(29.5)	50.0		13.5	(25.5)	100		5	(6)	50.0		9.5	(22.5)
	Nor	100		10	(17.5)	99.0		3	(7)	98.9		3.5	(4)	99.0		3	(5.5)
	Dev&Nor	99.0		4	(7.5)	99.0		3	(5)	99.0		3.5	(5)	99.0		3	(5)
10	Dev	18.5	(74.1)	8	(7)	39.8	(78.7)	24	(12)	48.1	(82.6)	22	(14)	37.8	(80.3)	24	(8)
	Nor	69.6	(100)	25	(17.5)	86.7	(97.6)	24	(12)	82.3	(98.6)	25	(8)	86.4	(98.1)	24	(11)
	Dev&Nor	55.2	(92.7)	29	(22)	59.1	(92.2)	27	(19)	58.3	(96.9)	28	(11.5)	58.3	(93.1)	27	(18)
11	Dev	0	(61.1)	25.5	(13)	38.1	(79.4)	28.5	(11)	27.8	(88.3)	31	(19.5)	28.7	(77.0)	31	(12)
	Nor	55.1	(100)	33	(17.5)	82.0	(92.4)	30.5	(24)	52.8	(99.8)	31	(24)	82.6	(95.2)	32	(24)
	Dev&Nor	44.8	(96.7)	36	(22)	49.0	(89.9)	35	(24)	47.9	(98.5)	35	(26.5)	48.1	(90.1)	36	(24)
12	Dev	18.8		9	(22)	50.0		13.5	(25.5)	77.3		10	(23)	49.5		12	(25)
	Nor	100		10	(17.5)	75.7		20	(34)	86.1		22	(34)	79.1		19	(34)
	Dev&Nor	81.5		19	(34)	69.8		21	(35)	80.8		21	(34)	71.6		21	(33)
13	Dev	11.8		15	(34)	53.4		9	(21)	50.8		19	(30)	47.4		13	(26)
	Nor	100		10	(17.5)	88.0		14	(23)	78.5		15	(30)	80.6		14	(29)
	Dev&Nor	84.4		17.5	(32)	82.5		15	(30)	75.0		18.5	(51.5)	81.4		16	(31)
14	Dev	28.8		6	(20.5)	50.0		13.5	(25.5)	50.0		23.5	(51.5)	47.2		14	(27)
	Nor	100		10	(17.5)	91.7		11	(25)	87.7		12	(27)	92.4		11	(25.5)
	Dev&Nor	95.8		8	(14)	89.1		12	(26)	85.4		14	(29)	89.6		11	(25)
15	Dev	14.8	(64.3)	12.5	(10.5)	54.8	(87.9)	27	(14)	57.1	(92.9)	30	(12.5)	56.4	(71.5)	25	(13)
	Nor	58.8	(100)	30.5	(17.5)	58.7	(99.1)	28	(5.5)	58.1	(97.6)	29	(12)	58.2	(99.0)	28	(5.5)
	Dev&Nor	58.1	(94.8)	35.5	(18)	56.0	(94.5)	29	(15)	58.5	(96.9)	31	(11.5)	58.4	(96.0)	29	(15)
16	Dev	14.8	(64.3)	12.5	(10.5)	58.8	(83.8)	25	(5)	85.7	(92.9)	29	(12.5)	54.2	(82.2)	27	(6)
	Nor	54.8	(100)	34	(17.5)	54.8	(95.7)	29	(17)	67.8	(91.5)	34	(21)	53.4	(95.7)	31	(19)
	Dev&Nor	50.0	(94.8)	36	(18)	53.1	(94.0)	30	(16)	66.9	(91.7)	36	(20)	51.6	(95.8)	34	(17)
17	Dev	No deviations indicated.															
	Nor	100		10		100		1.5	(1.5)	100		1.5	(1)	100		1.5	(1.5)
	Dev&Nor	100		1.5	(1)	100		1.5	(1.5)	100		1.5	(1)	100		1.5	(1.5)
18	Dev	No deviations indicated.															
	Nor	100		10	(17.5)	100		1.5	(1.5)	100		1.5	(1)	100		1.5	(1.5)
	Dev&Nor	100		1.5	(1)	100		1.5	(1.5)	100		1.5	(1)	100		1.5	(1.5)

TABLE I (continued)

Item***		Physicians Among Themselves		Rank		Teachers With Physicians		Rank		Teachers Among Themselves		Rank		All Interviews		Rank	
10	Dev	57.5		4	(19)	66.7		3.5	(15.5)	62.5		15	(27)	61.1		5	(19)
	Nor	100		10	(17.5)	83.4		16	(31)	59.3		13	(28)	84.1		15	(30)
	Dev&Nor	84.4		17.5	(52)	79.2		18	(53)	79.1		11.5	(53)	79.9		18	(33)
20	Dev	75.0		1	(6)	82.0		2	(9)	65.3		7.5	(19.5)	81.0		1	(7)
	Nor	100		10	(17.5)	80.9		17	(32)	84.3		21	(35)	82.0		17	(32)
	Dev&Nor	90.6		11.5	(25)	81.3		10	(31)	74.0		20	(53)	81.6		15	(30)
21	Dev	0	(66.4)	25.5	(17)	38.1	(83.4)	28.5	(6.5)	55.6	(100)	21	(6)	40.0	(64.6)	21	(15)
	Nor	57.5	(100)	32	(17.5)	82.0	(98.0)	30.5	(10)	64.4	(95.4)	24	(14)	86.0	(97.9)	29	(12)
	Dev&Nor	82.1	(96.9)	33.5	(18)	80.5	(96.6)	35	(12)	65.5	(95.8)	25	(15.5)	83.9	(96.2)	32	(13.5)
22	Dev	0	(61.0)	23.5	(14)	40.0	(82.5)	25	(7)	40.0	(90.0)	27.5	(18)	33.3	(80.0)	30	(8)
	Nor	59.8	(100)	29	(17.5)	80.9	(94.5)	33	(20.5)	80.0	(97.7)	33	(11)	82.2	(95.9)	34	(18)
	Dev&Nor	73.1	(85.8)	31.5	(14)	67.8	(93.2)	34	(17)	69.0	(96.9)	34	(11.5)	80.2	(94.3)	35	(18)
23	Dev	0	(100)	23.5	(2)	25.0	(75.0)	32	(15)	0	(100)	32	(6)	18.7	(82.7)	32	(5)
	Nor	68.4	(100)	26	(17.5)	87.1	(91.5)	27	(26)	51.6	(89.5)	32	(25)	88.1	(90.4)	27	(25.5)
	Dev&Nor	87.7	(100)	25	(5)	86.9	(91.1)	28	(21)	51.0	(89.6)	33	(25)	87.6	(92.4)	28	(21)
24	Dev	3.4		18	(28)	45.8		20	(30)	62.1		16	(29)	41.5		19	(31)
	Nor	100		10	(17.5)	76.1		18	(33)	68.7		29	(32)	78.9		18	(33)
	Dev&Nor	70.8		23	(36)	67.7		23	(36)	66.7		23	(36)	68.1		23	(36)
25	Dev	0	(88.3)	23.5	(4)	33.4	(97.5)	31	(3)	66.7	(100)	13.5	(6)	33.4	(88.9)	29.5	(3)
	Nor	71.4	(100)	23.5	(17.5)	85.1	(99.1)	29	(5.5)	83.6	(95.2)	30	(15)	87.6	(98.6)	28	(8)
	Dev&Nor	82.5	(97.9)	26	(20.5)	82.4	(97.7)	31	(7)	83.2	(95.9)	32	(15.5)	84.3	(97.4)	30	(10)
26	Dev	0		23.5	(29.5)	50.0		13.5	(25.5)	100		3	(8)	50.0		9.5	(22.5)
	Nor	100		10	(17.5)	96.3		7	(18)	94.7		7	(16)	98.0		7	(16.5)
	Dev&Nor	98.0		4	(7.5)	95.9		7	(14)	94.8		8	(17.5)	96.2		7	(13.5)
27	Dev	0		23.5	(29.5)	50.0		13.5	(25.5)	60.0		18	(29)	45.3		15	(30)
	Nor	100		10	(17.5)	96.1		9	(19)	92.3		10	(20)	95.4		8	(20)
	Dev&Nor	94.9		9	(12)	92.7		8	(25)	90.6		11.5	(23)	91.7		8	(19)
28	Dev	88.7		2	(8.5)	83.4		1	(8.5)	88.7		13.5	(26)	77.8		2	(11)
	Nor	100		10	(17.5)	97.9		5	(11)	97.8		5.5	(9.5)	98.2		5	(10)
	Dev&Nor	98.0		4	(7.5)	97.4		6	(9.5)	96.9		6.5	(11.5)	97.6		5.5	(8.5)
29	Dev	0		23.5	(29.5)	58.3		7	(20)	100		3	(8)	55.6		7	(20)
	Nor	100		10	(17.5)	98.9		4	(8)	97.8		6.5	(9.5)	98.9		4	(7)
	Dev&Nor	96.9		7	(12)	97.7		5	(7)	97.9		5	(17.5)	97.8		5.5	(6.5)
30	Dev	53.3		6	(20.5)	66.7		3.5	(15.5)	56.7		6	(15)	64.5		5	(16)
	Nor	100		10	(17.5)	88.9		13	(28)	92.6		9	(19)	91.4		12	(27)
	Dev&Nor	80.8		13.5	(27.5)	85.4		14	(29)	91.7		9.5	(20)	87.2		13.5	(20)
31	Dev	12.5		14	(23)	50.0		13.5	(25.5)	50.0		23.5	(31.5)	43.8		16	(29)
	Nor	100		10	(17.5)	83.6		15	(30)	69.3		19	(31)	83.9		16	(21)
	Dev&Nor	98.7		10	(22)	80.7		17	(52)	67.7		22	(55)	80.6		17	(32)
32	Dev	0	(80.0)	23.5	(5)	50.0	(80.0)	13.5	(2)	40.0	(100)	27.5	(6)	40.0	(90.0)	21	(2)
	Nor	80.4	(100)	28	(17.5)	81.1	(96.7)	32	(14)	58.2	(96.6)	27	(17)	81.8	(98.9)	30	(15)
	Dev&Nor	87.3	(90.0)	27.5	(7.5)	81.1	(96.4)	32	(13)	57.3	(94.9)	29.5	(17.5)	83.1	(96.6)	31	(12)
33	Dev	0	(100)	23.5	(2)	50.0	(50.0)	13.5	(25.5)	100	(100)	3	(6)	30.0	(53.0)	9.5	(22.5)
	Nor	58.5	(100)	30.5	(17.5)	48.5	(97.1)	34	(13)	61.7	(98.8)	26	(13)	52.3	(97.6)	33	(14)
	Dev&Nor	87.3	(100)	27.5	(5)	48.5	(97.4)	36	(9.5)	62.5	(96.9)	26.5	(11.5)	52.3	(97.0)	33	(9)
34	Dev	0	(100)	23.5	(2)	50.0	(100)	13.5	(1)	33.3	(100)	30	(6)	30.9	(100)	23	(1)
	Nor	72.0	(100)	22	(17.5)	61.0	(98.1)	25	(7)	50.1	(98.9)	28	(4)	56.2	(98.5)	25	(8)
	Dev&Nor	69.8	(100)	24	(5)	60.4	(98.2)	25	(5)	57.3	(99.0)	29.5	(5)	61.5	(98.6)	24	(4)
All Items*	Dev	21.7	(45.1)	x	x	51.7	(88.0)	x	x	62.3	(80.0)	x	x	48.5	(88.2)	x	x
Apr. 25	Nor	84.8	(100)	x	x	77.4	(94.2)	x	x	78.1	(91.8)	x	x	78.4	(94.7)	x	x
	Dev&Nor	77.2	(92.7)	x	x	75.1	(90.8)	x	x	73.5	(90.3)	x	x	75.5	(91.1)	x	x

* Based upon the total number of cases. (Not an arithmetical mean of all percentages).

** Height and weight (Items 2 and 3) included.

*** See Physical Inspection Record Form

Functional Tests IV: Vasomotor Weakness and Postural Fainting

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When the human subject changes from recumbency to the standing posture, the relative alteration in hydrostatic pressure in the circulatory system results in increased passive stretching of the vessels and pooling of blood in the lower limbs and abdomen, and a loss of pressure and consequent anemia in the brain and other organs in the higher parts of the body. As these effects seem to be qualitatively similar to those produced by the high-magnitude gravitational and centrifugal forces encountered by military flyers during combat maneuvers, it is not at all surprising that there is currently considerable interest in the phenomena and their relation to physical fitness.

Historically, there has been for some years an increasing scientific interest in the phenomena *per se*, since the physiological compensatory adjustments to the altered hydrostatic conditions of the circulation are quite complicated, delicately controlled, and of crucial biological significance to the organism in normal life situations. Less precisely controlled than other of the adjustments, the increased venous return caused by the massaging action of the muscles during bodily movement is typically most important in insuring adequate circulation in the higher nerve centers. When nearly complete muscular inactivity is enforced in the erect posture, the other mechanisms are just barely effective in maintaining this circulation, and a surprisingly large number of individuals will faint in such circumstances. The detection of individual differences in adequacy of the adjustments and effects of physical condition on them has been under investigation for many years, but interest has been sporadic.

As long ago as 1905, Crampton was making use of the postural effect in devising one of the very earliest cardiovascular tests of functional efficiency; Leonard Hill[10] had studied the hydrostatic effect in the dog, cat, and monkey in 1895, and Hill and Bernard,[11] in 1897, had considered the importance of the effect in humans. The work of Erlanger and Hooker[7] in 1904 should also be mentioned as being of significance.

In addition to his two 1905 studies, [2, 3] Crampton supported his

* Superior figures refer to numbered bibliography at end of article.

test with publications in 1913,[4] 1915,[5] and 1920,[6] and Sewell[14] reported a study in 1919. Schneider,[12] in 1920, made use of Crampton's test items of heart rate and systolic blood pressure changes due to altering posture from reclining to standing. To these he added reclining and standing heart rates and rapidity of return to normal following a brief exercise. This Schneider "Index" has been widely used. Crampton's original test, however, has fallen into disfavor, having been attacked by Scott[13] in 1921 and Wells[16] (indirectly) in 1934. Wells was of the opinion that the work of Addis[1] (1922) on posture-circulation tests was the best that had been done; he states that "the trouble with the postural test is that the effect is so small that it is within the probable error of a single test. This applies not only to the systolic drop, but the rise in pulse rate as well." It will later be shown that with proper choice and standardization of time and method of changing posture and determining systolic pressure, this criticism needs to be tempered.

Of special significance in relation to present interests, the work of Turner[15] in the late 1920's led to the use of the tilt-table and other techniques employed in the present investigation. An excellent summary of her work was published in 1930.[15] Graybiel and McFarland[8] (1941) have recently reported a comprehensive study on circulatory responses in the tilt-table experiment; this publication reviews both the physiological adjustments involved and their importance to aviators.

The present investigation represents an extension of the study of Graybiel and McFarland. The detailed physiological findings are of considerable interest in themselves, and will be reported elsewhere. This paper will be limited to the development and validation of practical tests of individual differences in circulatory adjustment to erect posture. Data are available on 29 male university students of college age, consisting of all members of a body-building class who were willing to serve as "guinea-pigs," and had taken no systematic exercise during the preceding three months.* The nature of the experiment was not divulged at the time of drawing the sample. They were removed from the class at the beginning of the semester, and kept on foot-conditioning and mild arm-stretching exercises until all had been through the experiment.

METHOD AND PROCEDURE

The tilt-table consisted of a shallow rectangular trough 60x180 cm., the bottom formed of 2 cm. plywood, and the sides formed of 12x2 cm. boards that stiffened the bottom longitudinally. This was pivoted near the center to heavy wooden supporting standards, the

* The writer is indebted to Mr. Charles A. Pease, Associate Supervisor of Physical Education at the University of California, for making these subjects available.

center of rotation being 110 cm., above the floor. A padded head-rest 4 cm. thick and 2/3 the width of the bottom, extended from 60 to 80 cm. in one direction from the pivots, and a right-angled foot-board was adjustable between 85 and 105 cm. in the other direction. The pivots were fastened to the sides of the trough, the center of rotation being 10 cm. above the bottom board. Stops and latches were provided to secure the board in the horizontal position and at 65° inclination. This nearly vertical tilt seems more effective than a completely vertical position, since the subject's weight is partly supported by his back, encouraging better relaxation.

An estimate of changes in volume of the lower leg was secured by observing the pressure changes in a 12.5x25 cm. rubber blood pressure cuff of the type used in sphygmomonometers, wrapped snugly around the right lower limb just above the malleolus, the ends of the cuff overlapping at the tendon of Achilles. The cloth bandage of the cuff was lengthened so that the full-width portion was 110 cm. long; the tapered portion added about 70 cm. additional length. The cuff was connected to a U-shaped water manometer 85 cm. long, having a bore of 4 mm. The inflation bulb was backed by a pinch-cock to prevent leakage, and fine pressure adjustments were made by compressing a rubber side-tube in the pneumatic line with a broad screw clamp. Pressure changes were scored in terms of mm. rise in the water column, which represented one-half the true pressure. The initial pressure of 210 mm., which corresponded to a true pressure of 31 mm. of mercury, was applied as soon as the subject was placed in the horizontal position; this was readjusted one minute before and again immediately before tilting.*

The ankle cuff was also connected to a mechanical device that gave a continuous pressure record, the sensitivity being about twice as great as that of the manometer. This refinement would be unnecessary for field use of the test.

Blood pressures were taken with the usual auscultation technique, the cuff being applied just above the elbow. A mercury manometer was used. Care was taken to record the *highest* systolic pressure that occurred during a 15- or 20-second observation period; fourth-phase diastolic pressures were used. Heart beats were electrically recorded on a polygraph tape, but manual counts would have been satisfactory.

The subjects had not eaten or exercised for two hours preceding the test. They rested in the reclining position for 15 minutes before tilting; during this period the necessity for standing relaxed and

* The sensitivity of the manometer is dependent on the total mechanical volume of the pneumatic system; in the present case, this was 64 cc. The ankle cuff, inflated to 31 mm. of mercury, was found to contain about 60 cc. (reduced to 25°C, and 760 mm. Hg.) A 15 per cent increase in total mechanical volume was found to lower the sensitivity about 8 per cent.

without shifting the weight from foot to foot was explained. This was emphasized by demonstrating that the ankle-pressure recorder was sensitive to very slight movements. An attempt was made to standardize the method of tilting; the change to 65° was made as smoothly as possible, and required about 3 seconds. The subjects were kept in the 65° position for at least 22 minutes (unless they fainted sooner); several additional minutes were allowed if there was obvious evidence of circulatory embarrassment or other signs of approaching syncope.

MEASUREMENTS USED

1. Pressure rise in the ankle cuff, taken 5 minutes after tilting.
2. Systolic pressure, average of minutes 2 and 4 pre-tilt, and of minutes 2 and 4 post-tilt.
3. Diastolic pressure, as in No. 2.
4. Heart rate counts, average of minutes 1 and 3 pre-tilt, and during the 60-second interval from minute 3 to minute 4 post-tilt.

From these basic measures were derived several additional test items, namely:

5. Pulse pressure (difference between systolic and diastolic).
6. Mean pressure (average of systolic and diastolic).
7. Pulse product (heart rate multiplied by pulse pressure).
8. Pulse product divided by mean pressure.*

Other derived items were secured by calculating the change produced in each item as a result of the tilting. Interestingly enough, only this last-mentioned category of items was found to have significant weighting in the multiple regression equations. The others, therefore, will receive no future mention.

EXPERIMENTAL RESULTS

The data at hand permit the calculation of Crampton test scores. There is a statistically significant difference between the means of the fainters and non-fainters ($t = 2.7$), but because of the extensive over-lapping (Fig. 1) the test is obviously of limited value for individual prediction. Crampton's test can be materially improved by re-weighting his items. In his scoring table, he gives each mm. Hg. of systolic blood pressure change twice the weight of each unit change in heart rate; this really amounts to giving systolic pressure a weight of 3, when the variability of each item is considered. The critical ratio rises to $t = 3.5$ when the raw scores of the two items are added together using their natural weights; this procedure gives the heart-rate change a relative weight of about 1.5, which does not differ very much from the theoretically optimum weight of 2.1 computed from the multiple regression equation. This naturally

* Dr. H. J. Ralston of the University of California Medical Center, San Francisco, suggested the inclusion of this item.

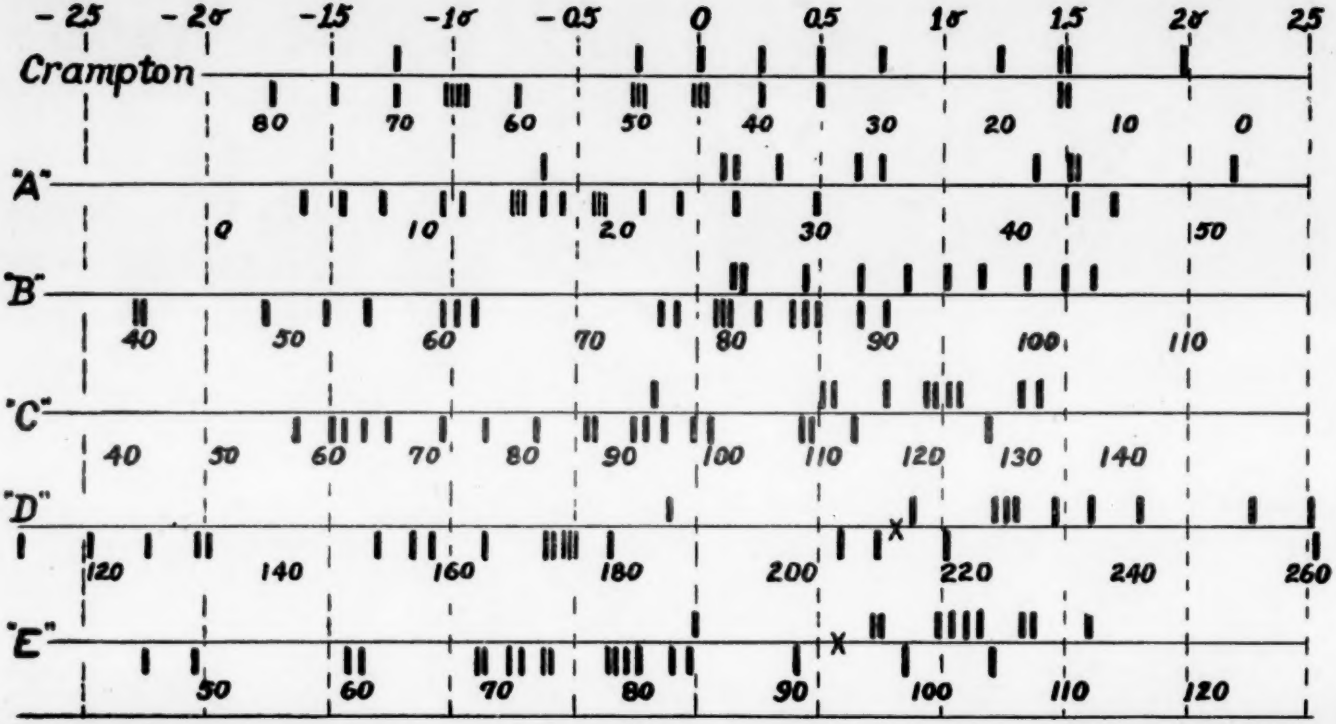

FIG. 1.

Individual scores of fainters (above the line) and non-fainters (below the line) for each test battery. The standard abscissa is in σ units. Suggested critical scores are indicated by x.

weighted test battery yields a validity coefficient of $r = .75$. (the criterion used here is the dichotomy, fainters-non-fainters, and the coefficient is calculated as biserial r in accordance with the customary method). This test is labeled A in Fig. 1.

Two other naturally weighted test batteries are very effective in predicting the later occurrence of fainting. Form B is simply the sum of the ankle-pressure rise and item 8 drop. Its validity is $r = .82$, and the critical ratio between fainters and non-fainters is 5.0. Form C, scored by adding together ankle-pressure rise, systolic pressure drop, and heart-rate rise, is slightly less valid ($r = .80$, $t = 4.9$). It has the advantage of simplicity, since diastolic pressure measurements and item 8 calculations are omitted.

Form C is improved by weighting the items in accordance with the coefficients of a multiple regression equation, namely 1.7 (ankle pressure rise) + 2.8 (heart-rate rise) + 1.0 (systolic pressure drop). Using these weights, it becomes Form D, which has a validity of $R = .88$, and yields a critical ratio of $t = 5.5$.

The battery of highest validity ($R = .93$ and $t = 6.9$) appears to be Form E. In round numbers this consists of 0.8 (ankle- pressure rise) + 1.0 (heart-rate rise) + 1.0 (item 8 drop), the first item being scored as mm. rise of water in the ascending limb of the manometer. Multiple regression equations involving four and five items did not yield appreciably higher validities than this battery.

DISCUSSION

The relative item-weights derived from the regression equations must be considered as tentative since they are based on a rather small sampling. Another point, frequently neglected by test constructors, is that the application of these equations to a new sampling* will yield lower validity coefficients. Recognition of these facts motivated the calculation of the naturally weighted batteries, (A, B, and C) and the very respectable validity coefficients yielded by them would seem to justify confidence in the statistically weighted batteries (D and E).

There are other lines of evidence that may be advanced in their support. First, there are positive correlations, among the subjects who fainted, between the rapidity with which fainting occurred after tilting and the magnitude of their test scores. These start with $r = .21$ for the 2 item batteries, and increase approximately in proportion to the validity coefficients, being .37 for test C, .44 for Test D, and .75 for Test E. Secondly, there are positive correlations between weakness of abdominal musculature as measured by a V type "sit-up"

* Since this paper was written, a new sampling of 80 subjects has been tested. The validity is found to be r = .73 for Form D and .88 for Form E. The critical scores of this sample are about 15 per cent lower than the original, due in part to the fact that it is composed of individuals who have passed military medical examinations.

is in σ units. Suggested critical scores are indicated by x.

and poor test-battery scores. The coefficients are $r = .23$ for A, .47 for B, .46 for C, .49 for D, and .55 for E.

The implications of the last-mentioned correlations are extremely interesting, for it would seem on physiological grounds that excessive splanchnovascular pooling of blood in the erect posture might well be expected to be related in some degree to poor muscular development and presumably poor tonus in the abdominal region. Preliminary results of experiments now in progress indicate that general body-building exercises reduce the incidence of fainting, but that specific exercises designed to strengthen the muscles of the thigh and particularly the abdomen are far more effective in this respect. The explanation of the favorable effects of these specific exercises is not entirely clear, and it may well be that some indirect factors are involved.

It would be decidedly wrong, however, to assume that abdominal muscular strength could be taken as a test of fainting tendency. There is some difference in the mean strength scores of fainters and non-fainters, but there is no significant validity since the correlation coefficient is no larger than its standard error. A possible but rather speculative explanation of this finding can be based on the assumption that the neuro-circulatory postural adjustments are largely innate.

Graybiel and McFarland[8] mention that an occasional subject will suddenly faint during the tilt-table experiment, without previous circulatory indications of impending syncope. One such subject was found in the present study; this individual consistently gave a fairly good score in all of the test-batteries. Two non-fainters made rather poor scores, but they seem to be correctly placed since detailed examination of their physiological adjustments during the 22 minutes they remained in the 65° posture reveals decided circulatory insufficiency in some later part of the experimental period. Thus it would seem logical to place the critical score of each test battery at or just above the score of the third highest non-fainter. For batteries D and E, this will "pass" 90 per cent of the non-fainters and "fail" 90 per cent of the fainters.

Interpretation of the significance of the absolute values of the validity coefficient depends, in part, on the assumption of statistical normality of the fainter-non-fainter dichotomy. This cannot be tested directly, but it does not appear to be an unreasonable assumption. Fainting is a *result* of poor physiological response to the altered posture. Had the effect of gravity been lessened by using only a very small angle of tilt, there can be little doubt that none of the subjects would have fainted. On the other hand, if the gravitational force had been greatly increased (which could have been done by swinging the subject's feet outward in a large centrifuge), undoubtedly all would have fainted. There seems to be good reason to believe that nearly

every subject suffered some circulatory embarrassment, and no reason to believe its degree was distributed in other than a normal manner.

Three of the test batteries may be considered suitable for practical use. Form A, the re-weighted and modified Crampton test, is the simplest, but its validity is too low to justify its use for measuring individual differences if much precision is desired. Form D has the advantage of avoiding diastolic pressure determinations (which require considerable skill, are low in reliability, and not too well standardized). The scores require few computations. Form E, however, has the highest validity.

These are not tests of general physical fitness, which is an extremely complex thing, and has many aspects. They are measures of what may loosely be termed "vasomotor weakness." This particular weakness is currently of interest for military reasons, and the new tests may be expected to be useful not only in the selection of unfit individuals, but also in developing exercise programs to improve condition in this specific respect. It may here be suggested, also, that a high degree of vasometer integrity will very likely be found to be an asset in resisting certain of the undesirable effects of hot humid climates and bad ventilation conditions. This vasomotor weakness should also receive adequate consideration in normal times, and Turner's[15] convincing argument of 1930 has not received the amount of attention it deserves.

It is interesting to note that the Crampton test was the only one of seven well known cardio-vascular tests that showed a decrement in a recent experiment on the effects of enforced insomnia[9].

There are several suggestions that can be made with a view towards possible improvement of the tests developed in the present study. For one thing, the optimum amount of pressure in the ankle-cuff has not been determined. The sensitivity of the pressure indicator can be increased by using kerosene instead of water, by inclining the glass tubes, or by using a cistern type manometer. The use of two ankle-cuffs would increase the reliability; similarly, the addition of a post-tilt minute-one or minute-five pulse count might be of value. The necessity for, and the optimum length of, the pre-tilt rest period remains undetermined. The limitation of the test to five minutes post-tilt in the interests of brevity may or may not have been wise. The reliability coefficients of the tests are unknown; presumably they are fairly high in view of the magnitude of the validities. The criterion is probably not very reliable—the implication here is of course that the true validity is greater than the measured validity.

Several additional subjects have submitted to the experiment since the statistical work was completed. Subject E. S. had fainted in a preliminary test. He did not faint in the experiment itself but

came perilously close to syncope. He gave a "D" score of 213 and an "E" score of 98; these are just above the suggested critical score. Subject R. M. did not faint, but gave a poor circulatory response during the experiment even though he helped himself unfairly by moving his muscles and shifting his weight. He scored 215 in "D" and 100 in "E"; these are just above the critical points. Subjects M. K. and R. S., who came through the experiment in good shape, scored 119 and 142 in "D" and 55 and 69 in "E." These are well below the critical scores.

SUMMARY

Twenty-nine college men were subjected to a tilt-table experiment. Blood pressure, heart rate, and other measures having possible value as test items were secured. Ten of the subjects fainted in from 12 to 23 minutes after tilting.

A modified Crampton test, using the tilt-table to produce the postural change, discriminates between fainters and non-fainters, but has a validity coefficient of only .62. Re-weighting the Crampton test items raises this to .75. Adding a new test item, namely, pressure change in an inflated ankle-cuff that was presumably sensitive to limb-volume changes, gives a test of considerably higher validity. The addition of diastolic blood pressure, permitting the calculation of the ratio of pulse product to mean pressure, results in still higher validity.

The most valid test battery for predicting fainting consists of scoring the effects of tilting to 65° as 0.8 (ankle-pressure rise) + 1.0 (heart rate rise) + 1.0 (drop in ratio of pulse product to mean pressure), the measures being taken during 4 minutes before tilting. and five minutes after tilting. This battery yields a validity of $R = .93$ and a critical ratio of $t = 6.9$ between fainters and non-fainters.

A somewhat simpler battery, better suited to some practical applications, consists of 1.7 (ankle-pressure rise) + 2.8 (heart rate rise) + 1.0 (systolic pressure drop). This has a validity of $R = .88$ and a critical ratio of $t = 5.5$.

The significance of the validity coefficients is supported by the observation that the unweighted (i.e. naturally weighted) test items, when added, give reasonably high validity coefficients. Further support comes from the finding of positive correlations between test-battery scores and the elapsed time from tilting to fainting, and also between abdominal muscular strength and test scores. Preliminary results indicate that specific abdominal and thigh exercises are effective in reducing the incidence of fainting. The possibility of using the new tests to study certain of the debilitating effects of hot humid ventilation conditions and individual differences in resistance to such conditions is mentioned.

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Improvement in Motor Fitness Associated with Physical Education and Physical Fitness Clinic Work

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THE PROBLEM

ADMINISTRATION of the Chinning — Dipping — Vertical Jumping tests in all service classes for men at the University of Illinois during 1940-41 and 1941-42 makes possible the computation of improvement in these items of motor fitness and also in the Larson Composite Score.[1] The results should be of considerable value because of the large sample of young college men used, and the dire need of such information to show the influence of physical education on the motor fitness of young men in this trying period of national history, when physical manpower is at a premium. The study must consider only gross results, however, because no control groups were available to show the influence of such factors as: growth, age, summer programs, etc. This study reports the gross improvement in chinning, dipping, vertical jumping, and the composite weighted score, using Larson's formula:

Composite Score = 2.12 (Chinning) + 2.27 (Vertical Jump + 1.0 (Dips)

Wherein:

Chinning = Number of times.
Vertical Jumping = Inches above the standing reach.
Dips = Number of times on the parallel bars.

The study is limited to the assumption that the items and the composite test score measure significant aspects of motor fitness and predict concomitant changes in a wider range of physical aspects correlative with the conditioning which produced the changes in physical capacity.

EXPERIMENTAL PROCEDURE

During the first semester, 1940-41, and again in the second semester, approximately 2,600 male physical education students were tested. The second semester scores were tabulated and normed to produce the Illinois Rating Scales for Muscular Endurance and

A paper presented before the Research Section, Midwest Convention, Milwaukee, Wisconsin, April, 1942.

[1] L. A. Larson, "A Factor and Validity Analysis of Strength Variables and Tests with a Test Combination of Chinning, Dipping, and Vertical Jump," *The Research Quarterly*, 11:82-96 (Dec., 1940).

Power Capacity. These scales were used to rate and to motivate the students who subsequently took the tests. Most of the students were freshmen and sophomores.

In October, 1941, the service classes were again tested. In the meantime most of the students had engaged in an additional semester of physical education and some of the lower ones took additional conditioning in the Illinois Physical Fitness Clinic. The gross changes are given in Table I.* Changes in the percentile scales are shown in Table II.

In a further testing experiment students with scores in the lower 20 percentile range were tested again as they entered the physical fitness clinic to determine the reliability of the test scores. From one to two weeks intervened from the first to the second tests. The coefficient of reliability for the composite scores was found to be .718. The low reliability was traced to an "educational effect" wherein some students exerted themselves more fully the second time than on the first trial. They became educated to a higher level of effort and possibly improved other technicalities connected with taking the tests. The improvement averaged 4.59 percentile units with no special conditioning exercises intervening.

Some 154 students in the Physical Fitness Clinic were followed carefully to determine the influence of the two regular hours of skill instruction plus an additional two-hour conditioning period in the Physical Fitness Clinic for twelve weeks. Danish exercises, indoor steeplechase activities, endurance tests, and assorted activities of balance, flexibility, agility, strength, power, and endurance were included in the dosage. Inspections of physique, ratings, and individual consultations were given to individualize the program, to motivate the students and to gather data. These men were tested a third time and the overall improvement from the first to the third tests was computed as 30.25 percentile points and 33.96 per cent mean improvement in the composite scores. Six students retrogressed due to undetermined causes. The maximum range of improvement was 85 percentile points and 130 per cent.

CONCLUSIONS

The gross overall improvement for all students in the service classes 1940-41 to 1941-42 was:

Chinning	27.95%
Vertical Jump*	2.75%
Dipping	49.30%
Composite Score	6.78%

* Tables will be found at end of article.

* The writer believes that a power event of this type which includes a velocity factor is much less susceptible to training than the rhythmic muscular endurance events, such as chinning and dipping.

The relatively large improvement in dipping was due mainly to more careful standardization of the dipping test wherein the dipping was checked by the examiner's fist when the subject's upper arm became horizontal in the dips. Since Larson weighted the vertical jump 2.27 as compared with 2.12 for chinning and 1.0 for dipping, the relatively large improvement in dipping did not affect the composite scores very much which vary more with the vertical jumping scores.

The percentile scales require adjustment as shown in Table II.

The exact causes of the improvement are undetermined but are logically associated with the concomitant conditioning work experienced in physical education courses and the Physical Fitness Clinic.

The improvement of 154 students in the Physical Fitness Clinic during the first semester of 1941-42 was 30.25 percentile points on the 1940-41 scale, or 33.96 per cent as an average in the Larson composite score. This may be fairly compared with the 6.78 per cent gain in the entire group from 1940-41 to 1941-42. Students in the Physical Fitness Clinic show a much greater gain than would be expected due to growth, age, educational effect, and normal physical education classwork.

Since the correlation of the composite test scores with $\frac{\sqrt[3]{Wt.}}{Ht.}$ —.142, with the McCloy Classification Index, (6 Height + Weight) is —.329, and with —.429 with adipose tissue ratings, the improvement cannot be attributed to increased age, weight, or height.

The reliability of the Larson Composite Score (Chinning—Dipping—Vertical Jumping) was found to be .718 with the tests administered approximately one week apart and with no change in the exercise prescription. The relatively low correlation is due mainly to variations in will power associated with the chinning and dipping event, practically all students improving in these the second time.

Since the Larson Composite Score for Chinning—Dipping—Vertical Jumping correlated —.429 with adipose tissue (fat) ratings, .306 with vital capacity residuals, .152 with musculature ratings, .300 with dynamometer strength (sum of R. and L. grips, back and leg tests), and .447 with the all-around Inventory of Motor Fitness score, the improvement may be thought of as representing some gain in physical fitness. The Chinning and Dipping improvements are fairly specific muscular skill and endurance improvements. It is not to be presumed that the gain is perfectly correlated with improvement in other indices of fitness, such as immunity to disease, cardio-vascular and respiratory condition, flexibility, or even muscular strength of the maximum type. A further study is needed to show just what the Chinning—Dipping—Vertical Jump Test measures.

TABLE I

IMPROVEMENT IN MEAN SCORES
1940-41 to 1941-42

		Chins	Vertical Jump	Dips	Larson Composite Scores
1940-41	Mean	7.378	19.646	7.146	291.86
	N	2577	2567	2583	2592
	σ	3.184	2.580	3.894	38.60
1941-42	Mean	9.438	20.186	10.668	311.64
	N	3117	3116	3117	3099
	σ	3.934	3.716	4.76	68.0
Improvement in Mean Scores		27.95%	2.75%	49.30%	6.78%

TABLE II

CHANGES IN THE PERCENTILE SCALES
1940-41 to 1941-42

	Chinning		Vertical Jump		Dipping		Lars. Comp. Scores	
Percentiles	1940-41	1941-42	1940-41	1941-42	1940-41	1941-42	1940-41	1941-42
100	23.0	30.0	31.0	32.0	27.0	28	550	560
90	11.5	14.0	24.0	24.0	12.5	16.5	360	394
80	10.0	12.0	23.0	22.5	10.5	14.0	337	369
70	9.0	10.0	22.0	22.0	9.0	12.0	322	351
60	8.0	10.0	21.0	21.0	8.0	12.0	308	334
50	7.5	8.5	20.5	20.5	7.0	10.0	294	317
40	6.5	8.0	20.0	20.0	6.0	8.0	282	300
30	5.5	6.0	19.5	18.5	5.0	8.0	266	280
20	4.5	6.0	18.5	18.0	3.5	6.0	249	243
10	3.0	2.0	17.5	16.0	2.5	3.0	224	232
0	0	0	8	8	0	0	0	0

The Effect of Weight Loss by Dehydration and the Withholding of Food on the Physiologic Responses of Wrestlers

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THE practice of voluntary weight loss by dehydration, and the withholding of food so as to make wrestling weights, raises the question as to the effect of this procedure on performance. In order to throw some light on this question, a laboratory experiment involving weight loss and its effect on the responses which seem important in wrestling, was carried out.

THE RESPONSES INVESTIGATED

In selecting responses to be investigated two points were kept in mind: Are the responses important, and can they be accurately measured by laboratory methods, so as to show any effects which weight loss might have on them? The responses selected were as follows:

1. Neuro-muscular system
   a. Strength
   b. Steadiness of movement
   c. Accuracy of movement
   d. Reaction time
2. Cardio-vascular system
   a. Systolic blood pressure
   b. Diastolic blood pressure
   c. Resting heart rate
   d. Heart rate after exercise
   e. Recovery time after exercise
   f. The electrocardiogram
3. Respiratory system
   a. Breath holding, expiration
   b. Breath holding, inspiration
   c. Vital capacity
   d. Resting tidal air
   e. Respiratory rate
4. Oxygen requirements
   a. Resting oxygen

b. Oxygen debt
c. Recovery time

THE EXPERIMENTAL PROCEDURE

Thirteen wrestlers were selected as subjects. However, for various reasons, only five completed the entire experiment; a sixth did all the experiments except those pertaining to oxygen requirements. The size of the subjects is shown in Table I. In order to get figures which were representative of what one might expect from the group, each subject came to the laboratory on five different occasions, and the responses previously listed were measured. After this part of the experiment was completed, each subject submitted to the weight-loss procedures, and returned to the laboratory immediately for a sixth repetition of the measurements. By comparing the responses of the wrestler before voluntary weight loss with those after weight loss, a means was available for determining any change in responses due to the voluntary weight loss.

TABLE I

AGE, HEIGHT, WEIGHT, SURFACE AREA, AND WEIGHT LOSS OF THE SUBJECTS

Sub. No.	Age yrs.	Height ins.	Weight lbs.	Surface area sqm.	Weight loss lbs.	Per cent of weight loss
1	20	69	145	1.79	7	4.8
2	19	71	162	1.91	8	4.9
3	18	71	164	1.90	6	3.6
4	18	71	203	2.12	10	4.9
5	19	72	217	2.20	10	4.6
6	23	70	204	2.08	9	4.4

The weight loss part of the problem was supervised by H. M. Howard, Varsity Wrestling Coach at the University of Iowa. His were the orthodox procedures practiced by wrestling coaches generally. Briefly they consisted of the withholding of food and water for a time previous to the last measurement. In addition, the wrestlers worked on the mat, sat in the sweat box, alternated with towels and a heat lamp.

It was our intention that each wrestler should lose 5 per cent of his body weight. The exact weight loss and per cent of body weight lost is shown in Table I. The weight losses attained varied from 6 to 10 pounds, which represented from 3.6 to 4.9 per cent of the body weight.

Although there was some fluctuation in body weight from experimental day to day before the voluntary weight loss, it was never more than two pounds.

The results of the experiment are discussed by items under each system investigated.

THE NEURO-MUSCULAR SYSTEM

The results obtained from the four neuro-muscular tests are shown in Table II.*

The Strength Index.—The strength index was determined by taking the sum in pounds of the right grip, left grip, chest pull, chest push, back strength, and leg strength. The strengths were measured by standard dynamometers. Each subject had three trials each time he came to the laboratory, the highest reading being recorded as the strength. The figures in the column "before" are the means of five trials. The column "range" is the range of five trials, and the "after" column is the strength index after dehydration. The data show that the strength index after the weight loss falls in the range already established in every case. It is concluded that the weight loss did not materially affect strength.

Accuracy of Movement.—Accuracy of movement was measured by having the subject move a stylus between two brass plates which gradually converged so that at the apex the stylus could barely pass between them. The brass plates were set on a piece of glass which served as the runway for the stylus. The brass plates and stylus were in series with a battery and buzzer. When either plate was touched by the stylus the buzzer sounded, thus indicating the distance that the stylus had been moved successfully. One plate was calibrated in millimeters beginning at the wide end. The score was expressed in millimeters, which indicates the distance the stylus was moved down the converging pathway.

In this experiment, each wrestler made 50 trials each time he came to the laboratory. A summary of the data is shown in the second section of Table II. The column marked "before" is an average of 300 trials. The "range" column shows the range of the means. The "after" column is an average of 50 trials after weight loss. The data show that in every case except one, the mean performance after weight loss falls within the mean range before. In the one case the performance was better. The data indicate that the weight loss had no detrimental effect on accuracy of movement.

Steadiness of Movement—Steadiness of movement was measured by having the wrestler pierce holes of gradually decreasing diameters. The holes were numbered beginning with the largest (1, 2, 3, etc.). The smallest hole that the individual was able to pierce with a stylus without touching the sides was recorded as the score. The plate containing the holes, and the stylus were in series with a battery and buzzer. An unsuccessful performance was indicated by the buzzer.

Each time the subject came to the laboratory he performed 50 trials. A summary of the data is shown in the third section of Table

* Tables II-V will be found at end of article.

II. The column "before" is the mean of 300 trials. The "range" column gives the range of the means. The "after" column is a mean of 50 trials. The data show that in four cases the steadiness score after the weight loss falls in the range before the weight loss. In one case the "after" score mean is better and in one it is worse than any of the scores previously made. The data justify the conclusion that the weight loss had no appreciable influence on the steadiness of movement.

Reaction Time.—In this experiment, the time required for the wrestler to respond to a stimulus was measured. At the flash of a light the subject pressed a key as soon as possible. The time elapsing between the stimulus and the response was measured by a Dunlap chronoscope. The reaction time was measured in milliseconds.

Each time the wrestler came to the laboratory 100 reaction time readings were taken. The column "before" is a mean of 500 measurements. The "range" column shows the range of the five means. The column marked "after" is a mean of 100 readings. The data show that in three cases the means after weight loss fall in the range before weight loss. In two cases the mean reaction time is greater after weight loss and in one case it is less. Although the data are inconsistent, in four cases, losing weight did not slow the reaction time.

THE CARDIO-VASCULAR SYSTEM

The results of the five cardio-vascular tests are given in Table III.

Systolic Blood Pressure.—Resting systolic blood pressure was ecorded according to clinical procedure. The data show that in four cases after weight loss, the mean systolic blood pressure falls within the range recorded before weight loss. In two cases, it is two mm. Hg. lower than the lowest reading before weight loss. The weight loss had no appreciable effect on systolic blood pressure.

Diastolic Blood Pressure.—Diastolic blood pressure was recorded at the same time systolic blood pressure was taken. In five cases the diastolic blood pressure after the weight loss falls within the range of readings taken before the weight was lost. In one case it is slightly higher. Obviously, weight loss had no appreciable effect on diastolic blood pressure.

Resting Heart Rate.—In three cases the resting heart rate after the weight loss falls within the range obtained before dehydration. The three remaining cases had a slightly higher resting rate than any reading taken before the weight loss. When compared with the average of the initial measurements, the heart rate after the weight loss is found to be higher in every case. This is explained by the emotional reaction to extreme thirst.

Heart Rate After Exercise.—The exercise employed was stepping up on a stool 13″ high at the rate of 35 times per minute for one minute. The heart rate after exercise as recorded here was found by counting the pulse for one-half minute immediately after the exercise, and doubling this rate. Therefore, the rates were recorded per minute. As can be seen from Table III, the scores obtained after weight loss fall within the ranges already established for each individual. It is concluded that the loss of weight did not effect the heart rate after exercise.

Recovery Time.—The recovery time is expressed as the number of seconds required for the heart to reach its resting level, after the performance of 35 stool steps for one minute. The pulse was counted for consecutive 30-second intervals immediately after exercise. The recovery time represents the number of seconds from the beginning of the count up to, and including the 30-second interval when it reached the resting level. In all cases except one, the recovery time after weight loss fell within the range of that before weight loss. Subject 2 required 330 seconds to recover after exercise, after losing weight. We offer no explanation for this exceptional result. With the exception of this individual the loss of weight caused no deviation from normal recovery.

Electrocardiogram.—Electrocardiograms were made for each subject both before and after weight loss. They were all normal in both series. One case had premature beats before the weight loss, but these were not present afterwards.

THE RESPIRATORY SYSTEM

Scores obtained for the five respiratory tests are summarized in Table IV.

Breath Holding in Expiration.—The procedure was to have the subject hold a stop-watch, face in the palm of the hand so that he could not see it. When the subject was ready, he started the watch at the end of normal expiration. When he had held his breath as long as possible, he stopped the watch. Each wrestler was given three trials at each experimental period. The longest breath-holding time was recorded as the score.

In all cases except one the breath-holding ability of the subjects after the weight loss fell within the range of performance before weight was lost. Subject 3 was able to hold his breath longer after weight loss. In general, the loss of weight did not affect the breath-holding ability of these wrestlers.

Breath Holding in Inspiration.—The procedure was like that described for expiration, except the breath was held in inspiration. The breath-holding time of two subjects after weight loss fell within the normal range. Three subjects were able to hold their breath longer than normal. One subject could not hold his breath quite

as long as normal. The data indicate, at least, that weight loss did not decrease ability to hold the breath in inspiration.

Vital Capacity.—Vital capacity was measured by having the wrestler expire into a calibrated spirometer with the greatest possible expiration after the most forceful inspiration. Three trials were made during each experimental period. The greatest volume expelled in the three trials was recorded as the vital capacity. The vital capacity was less than normal after the weight loss in four cases, greater in one, and the same in one. The data indicate that the weight loss has a tendency to reduce vital capacity.

Resting Tidal Air.—Resting tidal air was measured by means of a Benedict-Roth spirometer. The resting tidal air was measured after 30 minutes or more of bed rest. A record was made over a period of from 6 to 8 minutes each time the wrestler came to the laboratory. The tidal air was recorded as the average volume per minute. The data show that in two cases the resting tidal air was less after weight loss than before, in two cases it was greater and in two cases it was the same. The data fail to show a trend in any one direction, relative to the effect of weight loss on tidal air.

Respiratory Rate.—The resting respiratory rate was determined from the records made in the measurement of tidal air. The data justify the conclusion that the weight loss did not alter the resting respiratory rate.

OXYGEN REQUIREMENTS

The results of the four experiments which were carried out relative to the effect of weight loss on oxygen requirements are shown in Table V.

Resting Oxygen Consumption.—Here also, the Benedict-Roth spirometer was employed. The oxygen used while resting was calculated from the record made to determine tidal air. The wrestler breathed oxygen for from 6 to 8 minutes. The amount of oxygen used per minute was calculated and corrected to standard conditions. The weight loss had no effect on the resting oxygen requirement.

Oxygen Debt.—Oxygen debt is defined as the difference between the resting oxygen requirement and the oxygen required after the cessation of work. Each subject did 35 stool steps each time he came to the laboratory. Immediately following the work, he assumed the resting position, and his oxygen requirement was measured until it reached the resting state. The amount of oxygen used, above the resting requirement, due to the exercise is expressed as oxygen debt. The data show that the weight loss had no effect on the oxygen debt.

Recovery time.—The recovery time is defined as the number of minutes needed to pay the oxygen debt acquired due to 35 stool steps. The recovery time was unaffected by the weight loss.

SUMMARY AND CONCLUSIONS

The effect of losing weight by withholding food, and by dehydration on the responses of wrestlers was studied experimentally. Eighteen responses involving the neuro-muscular, cardio-vascular, and respiratory systems, and oxygen requirements were measured in the study.

In order to determine the range and the mean response, the subjects performed each experiment five times on different days over a period of a month. At the end of this time, weight was lost by the orthodox methods employed by wrestling coaches when they desire to have a man make a lower weight class. Each experiment was repeated immediately after the weight was lost.

A comparison of the data collected after weight loss with those before justifies the conclusion that the weight loss experienced within the limits of this study, has no detrimental effect on the physiologic responses investigated except that there is a slight increase in heart rate, and a slight decrease in vital capacity.

This study indicates that a wrestler may safely lose weight up to five per cent of his body weight without suffering any deleterious effects.

TABLE II
THE EFFECT OF WEIGHT LOSS ON NEURO-MUSCULAR RESPONSES

Sub. No.	Strength index			Accuracy of movement			Steadiness of movement			Reaction time millisecs.		
	Before	Range	After	Before	Range	After	Before	Range	After	Before	Range	After
		1721			10			4			203	
1	2156	2351	2268	11	12	10	5	6	5	238	274	266
		2270			15			6			229	
2	2663	2990	2525	17	17	19	6	6	7	237	246	243
		2058			15			4			241	
3	2302	2497	2496	16	17	16	5	6	5	265	278	287
		3070			17			6			206	
4	3167	3275	3226	19	21	19	6	6	6	235	255	276
		2145			20			5			286	
5	2198	2251	2194	21	22	19	5	5	5	294	299	286
		2884			22			6			236	
6	3042	3200	3077	23	24	21	6	6	5	241	245	226

TABLE III
THE EFFECT OF WEIGHT LOSS ON CARDIO-VASCULAR RESPONSES

Sub. No.	Systolic blood pressure mm.Hg.			Diastolic blood pressure mm.Hg.			Resting heart rate min.			Heart rate after exercise min.			Recovery time sec.		
	Before	Range	After	Before	Range	After	Before	Range	After	Before	Range	After	Before	Range	After
		114			70			56			100			90	
1	126	138	118	72	78	78	61	66	72	104	110	110	90	90	90
		100			60			74			114			90	
2	104	108	102	66	70	74	84	100	96	131	144	144	108	120	330
		104			64			68			108			90	
3	107	114	110	69	76	72	72	80	80	113	120	108	90	90	90
		104			68			64			110			120	
4	117	126	120	71	78	72	68	72	76	115	128	120	135	150	150
		120			78			60			116			90	
5	121	122	118	80	84	78	69	80	80	125	140	134	90	90	90
		110			64			50			104			90	
6	114	118	108	70	76	72	52	54	55	108	112	112	105	120	90

TABLE IV

THE EFFECT OF WEIGHT LOSS ON RESPIRATORY RESPONSES

Sub. No.	Expiration breath holding sec.			Inspiration breath holding sec.			Vital capacity cc.			Resting tidal air cc.			Respiratory rate min.		
	Before	Range	After	Before	Range	After	Before	Range	After	Before	Range	After	Before	Range	After
		16			52			4120			434			11	
1	19	23	23	55	57	62	4197	4250	3620	484	520	405	13	16	14
		41			65			4468			511			12	
2	43	45	44	79	91	80	4578	4700	4449	545	607	434	13	14	15
		24			65			5390			520			13	
3	29	32	42	66	68	73	5416	5440	4660	540	572	578	15	17	16
		46			96			5135			462			13	
4	56	63	45	106	124	133	5230	5360	5310	567	682	520	15	17	12
		17			76			5174			665			8	
5	25	32	29	88	120	74	5223	5290	5076	747	867	694	9	10	9
		40			95			5292			809			6	
6	46	53	43	99	104	98	5454	5527	5680	932	1069	867	7	7	7

TABLE V

THE EFFECT OF WEIGHT LOSS ON O_2 REQUIREMENTS

Sub. No.	Resting O_2 cc./min.			Recovery O_2 cc.			O_2 debt cc.			Recovery time min.		
	Before	Range	After	Before	Range	After	Before	Range	After	Before	Range	After
		251			1940			777				
1	304	323	270	2032	2095	2021	815	968	863	4	3–5	3
		250			1704			729				
2	260	325	274	1853	2145	2092	814	895	890	4	3–5	3
		325			1560			810				
3	334	330	333	1865	1950	1810	867	924	898	3	3–5	3
		328			2100			1035				
4	354	402	351	2484	2543	2434	1078	1101	1039	4	3–4	4
		322										
5	344	380	352	.....	.....	.....	.....	.....	.....	....	.....	....
		302			2636			1650				
6	390	452	377	2929	3280	2592	1750	1828	1761	3	3–4	4

College and University Physical Education Programs After One Year of War

By Lawrence Rarick

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SINCE the entry of the United States into the war, approximately a year ago, curricular revisions have occurred in practically every branch of the collegiate program with the view of making these institutions valuable contributors to the war effort. The question of the physical condition of the young men about to enter the armed forces has been one that has rightly commanded much attention. Physical educators have been clamoring for years for an increased emphasis upon physical education in our colleges. Military men have freely expressed their dissatisfaction with the physical condition of the college men who report to them for military service. A few educators have recognized that our educational institutions are not satisfying this important need. Reeves[1] in his statement in the 1942 Inglis Lecture, leaves no doubt as to the concern of some educators—"Health and physical stamina are not only indispensable to normal efficiency and to individual happiness, but they are now conditions of national survival. Especially in the field of physical training, the schools have grossly neglected, in my opinion, their responsibility to pupil and nation."

What have the colleges and universities done during our first year of war to alter their programs of physical education? Even though the drafting of 18- and 19-year-olds and the calling up of the students in reserve programs now remove many of the curricular responsibilities from the colleges and universities, it may prove to be enlightening and of some future value if we attempt to answer this question.

A recent study by Jones,[2] of the current changes in the health and physical education content and requirements at the college levels shows the following trends:

1. 47 per cent of the institutions included in this survey have adopted some change in content, while 7 per cent more have changes under consideration.

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[1] Floyd W. Reeves, "Education for Today and Tomorrow," *The Inglis Lecture* (Cambridge: Harvard University Press, 1942).

[2] L. M. Jones, "Recent Changes in the Requirement and Content of Required Health and Physical Education for Men in Land Grant Colleges and Universities," RESEARCH QUARTERLY, 13:3 (Oct., 1942).

2. 35 per cent of the institutions have adopted an increase in time allotment.

3. Several colleges and universities have increased their emphasis upon the program of intramural athletics.

4. Some have placed or are planning to place greater emphasis upon "body-building exercises," such as calisthenics and conditioning activities.

5. Combative sports and first aid have received increased emphasis in other institutions.

The study by Jones shows certain general changes up to March, 1942, but no attempt was made to determine specific alterations in programs and physical education requirements.

GENERAL PURPOSE

The purpose of this study was to determine specific changes which colleges and universities have made relative to requirements and content in physical education since the entry of the United States into the war.

PROCEDURE

Questionnaires were sent to 101 selected colleges and universities in every state in the union. No attempt was made to make this selection a representative one, as only the larger and more prominent institutions in each state were chosen. Of the 101 questionnaires mailed, 73 were returned. Of the institutions returning questionnaires, 31 were state universities, 8 state colleges, 28 private colleges and universities, and 6 state teachers' colleges. The questionnaire was set up on the basis of a comparison of the physical education programs and requirements of the 1941-42 school year with those of the 1942-43 school year. This was done with the assumption that needed changes would be made by the fall of 1942.

RESULTS

Semesters of Physical Education Required for Graduation.— Table I shows the relative percentage of institutions requiring the indicated number of semesters of physical education in 1941-42 as compared to the 1942-43 school year. As will be noted, only three institutions required eight semesters of physical education in 1941-42, whereas 32 institutions require eight semesters this year. Where eight schools required no physical education in 1941-42, only one school in 1942-43 requires no credit in physical education for graduation. The median requirement for graduation was four semester hours in 1941-42. This has been increased to a median requirement of six semester hours in 1942-43. On the surface this appears to be a considerable increase; however, less than half of the schools or 45.75 per cent now require eight semesters of physical education for graduation.

TABLE I

SEMESTERS OF PHYSICAL EDUCATION REQUIRED FOR GRADUATION

Semesters	No. of Institutions 1941-42	Per Cent Requiring P.E.—1941-42	No. of Institutions 1942-43	Per Cent Requiring P.E.—1942-43
8	3	4.48	32	45.74
7	0	.00	1	1.43
6	4	5.97	5	7.15
5	1	1.48	0	.00
4	31	46.20	22	31.41
3	1	1.48	0	.00
2	19	28.20	9	12.82
1	0	.00	0	.00
0	8	11.90	1	1.43

Hours of Physical Education Activity Required Each Week.—Table II shows some increase in time allotment per week in the 1942-43 requirements at all grade levels over that of the preceding year. The average time allotment is also somewhat higher at each grade level. Table II gives a comparison of the hours of activity required per week as shown by the number of institutions requiring the amount indicated. As can readily be observed, the time allotment decreases from freshman to senior years. It might also be interesting to note that of the 73 schools included in this survey, only seven, or less than 10 per cent, give as much as one hour a day at all four grade levels.

TABLE II

HOURS OF PHYSICAL EDUCATION ACTIVITY REQUIRED EACH WEEK BY INSTITUTIONS

Hours per week	Freshman		Sophomore		Junior		Senior	
	41-42	42-43	41-42	42-43	41-42	42-43	41-42	42-43
6	....	....	1	1	0	0	0	0
5	2	8	1	8	1	7	1	7
4½	0	3	0	3	0	3	0	3
4	4	7	2	7	2	6	2	6
3	27	37	18	32	3	19	0	15
2	27	12	20	10	3	6	1	6
1	2	2	1	1	0	0	0	0
0	8	2	27	9	60	29	65	33

Table III shows the median and average weekly time allotment at each grade level for the two years in question.

TABLE III

MEDIAN AND AVERAGE PHYSICAL EDUCATION REQUIREMENT

	Freshman		Sophomore	
	41-42	42-43	41-42	42-43
Median	2 hrs.	3 hrs.	2 hrs.	3 hrs.
Average	2.33 hrs.	3.07 hrs.	1.60 hrs.	3.02 hrs.

TABLE III—(Continued)

	Junior		Senior	
	41-42	42-43	41-42	42-43
Median	0	2.5 hrs.	0	2 hrs.
Average	0.40 hrs.	2.01 hrs.	.22 hrs.	1.84 hrs.

Percentage of Time Given to Various Types of Activities.—One would logically assume that certain changes in program content would parallel the increased emphasis in physical fitness. How has the program of activities been altered to meet this need? Table IV shows the approximate percentage of time given to the six leading types of activities in the two years under consideration. As is shown by this table, the 1942-43 programs on the average place more emphasis now than formerly on calisthenics, combative activities, apparatus and tumbling, and aquatics. Somewhat less emphasis is given to team sports and individual sports than in 1941-42.

TABLE IV

APPROXIMATE PERCENTAGE OF TIME GIVEN TO VARIOUS TYPES OF ACTIVITIES

Year	Calisthenics	Team Sports	Individual Sports	Combatives	Apparative Tumbling	Aquatics	Other Activities
41-42	6.34	29.13	21.33	11.03	7.25	9.57	15.35
42-43	18.92	22.17	13.78	16.52	12.27	13.49	2.83

Required Activities.—Of the 61 institutions answering the question pertaining to required activities, 33 or 47.8 per cent indicated that they had required activities in 1941-42 or that students must pass a proficiency examination to satisfy these requirements. For the school year 1942-43, 54 of the 72 schools answering, or 75 per cent gave a positive reply to the question of required activities. Those most commonly required in the 1941-42 program were swimming by 18 of the institutions, and combative activities by seven. In 1942-43, swimming was required by 33, combative activities, by 17, and the obstacle course, by 14 institutions.

GROUP OF REQUIRED ACTIVITIES

1941-42 School Year	1942-43 School Year
yes — 33 or 47.8%	yes — 54 or 75%
no — 36 or 52.2%	no — 18 or 25%

ACTIVITIES MOST COMMONLY REQUIRED

1941-42 School Year	1942-43 School Year
Swimming — 18 or 26.1%	Swimming — 33 or 45.8%
Combatives — 7 or 11.3%	Combatives — 17 or 23.6%
	Obstacle Course — 14 or 19.4%

Testing Program Other Than Medical Examinations.—Table V shows the number of institutions and percentage of institutions

using a testing program in 1941-42 as compared to the present school year. As is shown by this table there has been a substantial increase in the number of institutions routinely using testing procedures.

TABLE V

INSTITUTIONS WITH A TESTING PROGRAM

	1941-42		1942-43	
	Number	Per Cent	Number	Per Cent
Yes	38	53.5	60	83.3
No	33	46.5	12	16.7

A wide variety of tests are in use with no single test predominating. In fact, there were few cases in which the tests as outlined in the questionnaires were duplicated by any two institutions. Many institutions use modifications of tests that are in use in the Navy, Army Air Corps, and Navy Pre-Flight training centers. The most commonly used test elements in the various batteries of tests are pull-ups and floor push-ups. Twenty-three institutions indicated that pull-ups and push-ups formed a part of their test batteries. The time on the obstacle course was used by five universities as a test of physical condition.

The following outline summarizes the use that is made of the test results.

Use Made of Tests	*Number of Institutions*
Measuring Individual Progress	23
Motivation	18
Grading	17
Classification	13
Guidance	4

Substitution of Varsity Athletic Participation for the Physical Education Requirement.—As will be noted from Table VI, varsity athletic participation does in general substitute for the physical education requirement. In 1941-42, 70 per cent of the institutions allowed such a substitution and in 1942-43, 63.8 per cent, which indicates very little change in policy.

TABLE VI

ATHLETIC PARTICIPATION AND PHYSICAL EDUCATION REQUIREMENT

	1941-42		1942-43	
Varsity Athletics Substitute for P.E.?	Number of Institutions	Per Cent	Number of Institutions	Per Cent
Yes	44	70	44	63.8
No	7	11	10	14.5
In Season	9	14.3	11	15.9
In Part	3	4.7	4	5.8
No Answer	10	....	4	....

Substitution of Intramural Participation for the Physical Education Requirement.—In general, intramural participation does not substitute for the physical education requirement in either year. As can be seen by Table VII, the trend is away from accepting intramural participation as a substitute. Only 7.1 per cent in 1942-43 accept intramural participation as compared to 13.8 per cent in 1941-42.

TABLE VII

INTRAMURAL PARTICIPATION AND PHYSICAL EDUCATION REQUIREMENT

	1941-42		1942-43	
Intramurals Substitute for P. E.?	Number of Institutions	Per Cent	Number of Institutions	Per Cent
Yes	9	13.8	5	7.1
No	54	83.1	63	90.0
In Part	2	3.1	2	2.9
No Answer	8	....	3	....

Change in Size of Full-time Instruction Staff and Number of Students Served in Required Physical Education Activities.—The 54 schools making an estimate of students served in required physical education estimated a net increase of 17,105 students in 1942-43 over that of the preceding school year. There was a net loss of 26 instructors during the same period of time. Table VIII shows the relative change in staff members to the change in students for the two years under consideration.

TABLE VIII

RELATIVE CHANGE OF STAFF TO STUDENT ENROLLMENT 1941-42 TO 1942-43

Staff	Number of Institutions	Per Cent	Enrollment in P. E.	Number of Institutions	Per Cent
Increased Staff	9	14.5	Increased Enrollment	35	64.8
Decreased Staff	20	32.2	Decreased Enrollment	5	9.3
No Change	33	53.3	No Change	14	25.9

Table IX is designed to show the percentage of male students by schools in required physical education activities. Only six institutions, or 10.5 per cent had 100 per cent participation in required physical education activities during the 1941-42 school year, whereas during the present school year, 22 schools, or 34.4 per cent indicated 100 per cent participation.

Individual Corrective Program.—In 1941-42, 4.7 per cent of the students in the physical education programs, covered by this survey were served by corrective physical education or by an adaptive program. In 1942-43 this was increased to 5.3 per cent. Table X shows the number and percentage of institutions that provide a corrective or adaptive physical education program.

TABLE IX

PERCENTAGE OF MALE COLLEGE STUDENTS BY SCHOOLS IN REQUIRED PHYSICAL EDUCATION ACTIVITIES

	1941-42		1942-43	
Percentage of Men in P. E.	Number of Institutions	Per Cent of Institutions	Number of Institutions	Per Cent of Institutions
100	6	10.5	22	34.4
80-99	2	3.5	12	18.7
60-79	15	26.3	17	26.6
40-59	14	24.6	6	9.4
20-39	12	21.1	4	6.2
0-19	8	14.0	3	4.7

TABLE X

INDIVIDUAL CORRECTIVE PROGRAM

	1941-42		1942-43	
Corrective Program Provision for	Number of Institutions	Per Cent of Institutions	Number of Institutions	Per Cent of Institutions
Yes	54	81.8	53	78.0
No	12	18.2	15	22.0

Physical Fitness Program.—Of the 70 colleges and universities responding to the question, "Have you a definite program to improve physical fitness of those below par?" 52, or 75.8 per cent, felt that they had such a program, while 17, or 24.2 per cent, had no such program. The replies to this question were naturally based upon the director's subjective opinion of what constitutes a program to improve physical fitness and whether or not the director feels that his program fits the criterion which he thinks is adequate. Obviously, then, the programs of the different colleges varied within rather wide limits.

The majority emphasized physical examinations, correction of remedial defects, conditioning activities with a gradual increase in dosage, and activities involving a marked degree of aggressiveness.

SUMMARY AND CONCLUSIONS

This study indicates that colleges and universities during the first year of war have made an attempt to improve their offerings in physical education to meet the need for increased physical fitness. The requirements for graduation as well as the increase in average time spent per week in required activities indicate that colleges were working toward an adjustment of their program. It is doubtful, however, that the small increase in time allotment indicated by this study would account for an appreciable increase in physical condition, even though the required program emphasizes activities which are of a conditioning type.

At the start of this year, colleges and universities were serving more men in physical education than during the previous year indicating a tendency to benefit a larger percentage of the male students.

The increased use of testing procedures is a favorable sign; however, it would seem desirable for institutions to reach an agreement on some one test so that universal standards of fitness and performance could be established for all men in all schools

This year's increased male enrollment in required physical education with an accompanying decrease in instructors will obviously be more than compensated for by the calling up of 18- and 19-year-old youths.

Emphasis placed upon calisthenics, combative activities, aquatics, and apparatus and tumbling indicates that physical education departments have tried to fit their activity programs to the present need.

The results of this study show that the institutions herein concerned have made many desirable changes in their physical education programs. Many directors indicated that only a few of their suggested recommendations were accepted by their respective administrations, thereby reducing the services to their students. This may in part account for the fact that approximately 25 per cent of the institutions included in this survey in the opinion of their directors have no definite physical fitness program.

The lack of uniformity in requirements, program content, and testing procedures leads one to question the total effectiveness of the physical fitness programs in our colleges and universities. In general, it would seem fair to conclude that the changes which have been made during this period should be considered only as half-way measures rather than an all-out change necessary for gaining the desired objective of physical fitness for all.

A Physical Conditioning Program as Conducted at Michigan State College

By R. B. DAUBERT
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SINCE Pearl Harbor considerable comment has been heard deploring the lack of physical condition of the young men who would constitute the bulk of our armies. With this in mind the staff of physical education instructors at Michigan State College devised a program of events known as the "Safety Skills Course," which was recommended to men who might be called to military service within the year. It was hoped that the course would secure for each student as high a degree of general physical conditioning as was possible in three one-hour periods per week, for eleven weeks. To accomplish this a number of objective activities were used, which could be measured or timed, and which were thought to be useful in producing physical efficiency, endurance, power, and agility.

Each class period was started with calisthenics of from five to fifteen minutes in duration, with no thought as to its immediate value except as it conditioned the body for the activities that followed. These activities consisted in the main part of running, throwing, climbing, carrying, crawling, pulling and pushing, and certain others, such as games of the vigorous type.

Standards for the various items were arbitrarily determined and although there was a wide discrepancy in the values set, as will be shown in the body of this report, they nevertheless served as bases for determining future values.

In the fall term there were five sections totalling 208 men, of which approximately 45 per cent had received notification of induction by July 1, 1942. Of this number about 80 per cent were upperclassmen which fact was responsible for orientation, and considerable enthusiasm was manifested in the comparative results of each skill. It is therefore clear that coercion was unnecessary and that voluntary effort was very much in evidence. The popularity of the course was also manifested by the minimum of voluntary absences taken by the students.

In the spring term there were 6 sections totalling 260 men most of whom were in the organized reserve of the armed forces and were subject to call at any time.

As is to be expected of any type of physical activity encompassing the rigorous workouts which were necessary in the fulfillment of the aims of such a course, certain accidents were unavoidable. It is to be noted, however, that they were of a minor nature. There were eighteen such accidents which consisted mainly of sprained ankles, pulled muscles, bruises, and abrasions. It is the thought of the committee that these were not too serious as to cause concern, but that certain activities could be modified so as to eliminate the danger of more serious accidents in the future without seriously affecting the value of the course.

It was found that by dividing the sections into squads, each with a squad leader, better results could be obtained thus enabling each man to maintain a continuous participation in the day's program, as well as to allow for frequent testings in the activities by the instructors.

The activities, standards, and procedures which were conducted are as follows:

1. Running:
   a) Jog two laps and walk one lap (early season).
   b) Balcony shuttle course (late season). Take every step; keep reasonable distance apart.
   c) Jog turn, sprint straightaway three laps (late season).
   d) Outdoor obstacle course.
   e) Obstable relays.

   (The standards of achievement have not been established for these activities, and cannot be until more data have been studied.)
2. Throwing:
   a) Medicine ball or sandbag throw.
      1) One arm, side arm (both arms).
      2) Overhead backward throw using both hands.

   Standard: One foot for every four pounds body weight.
3. Jumping:
   a) Simple high jump forms. (4′ 2″ to 5′ 0″)
   b) Broad jump: Running broad jump—13″; Standing broad jump—Performer's height plus 2′ 3″.
   c) Diving over bar. (Height of performer's nipples.)
   d) Jumping from height. (Balcony—10 feet.)
4. Vaulting:
   a) Bar vault. (Height of performer's nipples.)
   b) Pole vault for distance. (Eight feet measured from the point of contact of the pole with the ground.)
   c) Buck vault for height. (Straddle vault—5 feet.)
   d) Buck vault for distance. (No standard established.)
5. Climbing:
   a) Rope climbing. (Reaching as high as possible, standing on

tip-toe, climbing rope any style to top of rope in 12 seconds minimum.)

b) Ladder climbing, using any style. (Nine seconds minimum to top of ladder.)

c) Pole climb—procedure same as rope climb. (Eight seconds minimum to top of pole.)

d) Scaling walls. (Start 30 feet from wall; run and climb wall and return to starting line—10 seconds minimum.

e) Climbing on horizontal ladder.

1) Hand walk—starting both hands on rung at start and turn (40 feet in 15 seconds).

2) Hand-over-hand on single rail—both hands on rung at start and turn (40 feet in 15 seconds).

3) Going from a hanging position to a sitting position on top of ladder.

6. Carrying:

a) Carrying sandbags: Two-arm carry; hip carry; shoulder carry.

b) Fireman's carry. (In good form, using classmate of own weight from supine position to supine position.)

c) Two-man carry (chair carry and others).

d) Building sandbag barricades in competition.

(The standards of achievement have not yet been established.)

7. Crawling:

a) All-fours run (bear run).

b) Inverted all-fours run (crab run).

c) Fireman drag.

d) Night crawler tunnel—crawling through tunnels with sandbag.

1) Head first. (30 feet in 15 seconds.)

2) Feet first. (30 feet in 20 seconds.)

8. Pulling and Pushing:

a) Tug-of-war—doubles and groups or squads.

b) Charging sled—individual and group.

9. Dodging and running games:

a) Dodgeball.

b) Run-sheep-run.

c) Kick ball.

d) Stick relay.

e) Potato relay.

10. Strength tests:

a) Chins. (In good form—complete extension of arms and without swinging.)

b) Push-ups or floor dips. (Touching chest to floor and with back straight.)

(See Chart A for standards of achievement.)*

ROUTINES

INDOOR COURSE:

1. Climb to overhead support and return to floor by rope.
2. Run one lap around track to wall.
3. Scale the wall.
4. Run around track to tunnel.
5. Crawl through tunnel.
6. Run around track to finish line.

It is suggested that starting three men at a time will save time. Standards of achievement will be established when the course has been run by the class and an average struck. (See Chart A.)

OUTDOOR ROUTINE (To be run carrying a 40 lb. pack):

1. Start from the center fieldhouse door facing football practice field and climb brick wall in southwest corner of field.
2. Follow the sidewalk past the front of the gymnasium to the bridge; go to water's edge at left of bridge; pass through barbed wire fence. Turn left; come up bank; then continue on path until big tree is reached.
3. Cross river on ropes carrying pack. (Monkey style—use hands and feet, go head first.) Alternate: if not strong enough to cross on rope, ford the river at this point.
4. Continue along bank down river to point below old hospital. Climb bank at point indicated; turn left and continue down sidewalk to Michigan Avenue.
5. Turn left off sidewalk at end of cable fence near Michigan Avenue; follow path along river bank; continue on past stone dam, and cross broken rock area.
6. Ford river at shallow spot below rapids.
7. Crawl under post and wire obstacle on bank.
8. Continue along river bank to canoe docks.
9. Leave river bank; follow outside of practice field wall.
10. Scale wall into practice field at original point of scaling.
11. Finish at starting line outside of double door of field house.

EXAMINATION AND GRADING PLAN

Methods of testing are the responsibility of the individual instructor.

1. 25 tests—3 points each	75 pts.
2. Running indoor obstacle course in average time	5 pts.
3. Running outdoor obstacle course in average time	10 pts.
4. Healthmanship and sportsmanship	5 pts.
5. Individual estimate	5 pts.
	100 pts.

GRADING PLAN

90 points and above	A

* This chart will be found at end of article.

81 to 89½ points..... B
69 to 80½ points..... C
60 to 68½ points..... D
59 points or under..... F

The result of testing made by the men in the various activities surpassed the standards set up originally, as will be seen in Chart A. It is interesting to note, however, that several items follow the accepted trend as set up by authors in the field of tests and measurements. It is generally accepted that an individual's push-ups should double his pull-ups (chins). This "thumb rule" is not substantiated by any testings made so far as is shown in Chart A.

It is also interesting to note that the standard set for the standing broad jump is the individual's height plus 2′ 3″, which would require the average of the class to jump eight feet, as the average height was 5′ 9.6″. The average was actually 8′ .6″ in the fall term, and 8′ 5″ in the spring term where the average height was 5′ 10.15″.

There seems to be a correlation between rope climbing and pole climbing as is evidenced by the closeness of the average scores found when making a distribution. The ranges for rope climbing were from 8.0 sec. to 11.0 sec. while for the pole climb it is found to be from 7.5 sec. to 11.0 sec. This is probably due to the wide range of distribution for the pole climb while those for the rope climb were more or less bunched.

A study was made of several tests in order to establish norms for future classes as well as to check on the validity of existing standards. This was not possible for all the activities because of irregularities found to exist, such as lack of proper recordings, misunderstanding of the directions given, etc. Thus, the items which are given here will constitute the only changes of standards until more reliable data are available.

After making distribution curves the following results were obtained:

1. *Push-Ups*
   35-up excellent
   30-34 incl. good
   24-29 incl. average
   20-23 incl. fair
   1-19 incl. poor

2. *Pull-Ups* (Chins)
   15-up excellent
   12-14 incl. good
   9-11 incl. average
   5- 8 incl. fair
   1- 5 incl. poor

3. *Rope Climb*
   to 7.0 sec. excellent
   7.1 sec.- 7.9 sec. incl. good
   8.0 sec.-11.0 sec. incl. average
   11.1 sec.-12.9 sec. incl. fair
   over 12.9 sec. poor

4. *Pole Climb*
   to 5.5 sec. excellent
   5.6 sec.- 7.4 sec. incl. good
   7.5 sec.-11.0 sec. incl. average
   11.1 sec.-13.0 sec. incl. fair
   over 13.0 sec. poor

5. *Sit-Ups*
   75-up excellent
   61-74 incl. good
   41-60 incl. average
   25-40 incl. fair
   under 25 poor

A comparative study of various physical items was made for the years 1930 to 1942 and it showed a marked trend upward, as evidenced in the following table. Whether this is indicative of superior strength or skill cannot be determined except as one wishes to interpret the findings. It will be noted that men are growing taller and heavier.

	Weight	Height	Push-Ups	Chins	Broad Jump Standing	Depth of Chest	Width of Shoulders	Width of Hips
1930	143.7	68.0"	23.7	9.58	7'4"	11.0"	16.4"	12.7"
1931 to 1941	146.7	68.8"	25.0	9.75	7'6"	11.15"	16.55"	12.86"
1942 (Spring)	156.7	69.6"	26.4	10.2	8'6"	11.17"	16.6"	12.94"
1942 (Fall)	157.2	70.15"	26.53	10.14	8'4"			

Since the object of the course was to build, in some measure, physically fit men who would be better prepared than the average for military duty, certain Army camps were asked to provide a list of averages of the various physical activities for the purpose of making comparisons which could be used to set up values. It was clearly brought out that it takes from three to four weeks for the average man to become accustomed to the rigors of Army life.

The following table of comparisons will show the value of the safety skills course as it is being conducted at Michigan State College.

	Height	Weight	Chest Circ. Inspiration	Chest Circ. Expiration	Girth Upper Arm Exten.	Girth Upper Arm Flexion	Girth Abdomen	Push-Ups	Pull-Ups	Broad Jump
M.S.C.	69.6"	156.7	39.2	36.57	11.64	12.7	27.8	26.4	10.2	8'6"
Camp A	68.8"	158.4	39.6	36.5			31.8	25	6	6'
Camp B	68.0"	144.	39.0	35.0	11.3	13.3	31.0	19	8.2	7'10"

The coefficient of vital efficiency (physiological condition) as reported by Oppenheimer is determined by the formula, girth upper arm $\times$ 100 divided by the girth of chest in expiration. The standards set are:

Excellent	29 and above
Good	26 to 28
Poor	Less than 26

The results show that both M.S.C. students and Camp B soldiers are in the upper limits of the scale as follows·

M. S. C.	31.8
Army Camp B	30.0

Pignet's formula for muscular strength as reported by Martin in 1921 is (weight in kg plus chest at expiration in cm) — height in cm, and the result is weighed against the following table:

Under 10	Very strong
10 - 15	Strong
15 - 20	Good
20 - 25	Fair
25 - 30	Weak
30 - 35	Very weak

The relative strengths have been found to be as follows:

M. S. C. Students	12.48
Army Camp A	10.05
Army Camp B	18.42

According to Martin, the test is considered exceptionally good by many Army medical men, but its validity must be verified.

In making generalizations, it is significant to note that much emphasis was placed on activities requiring strength of the arms and back muscles. Consequently, many of the activities such as pole climb, ladder climb, and horizontal ladder walk could be dropped for testing since the rope climb and one of the ladder walks would be sufficient for tabulation. It is apparent that an item should be included to test abdominal strength such as "sit ups." This is of special value and should be given consideration since most leaders in the field of physical education believe that the strength of the abdominal muscles is a better indication of physical condition than any other one factor.

The results of the course were most gratifying since the immediate aims were realized. From an educational point of view the course was sound; the law of readiness had already been in effect because of Pearl Harbor. We had reached the stage where the young men were demanding a course that would prepare them for a critical situation. The law of practice was therefore effective throughout the term since the development of a skill was dependent upon other skills, while the law of effect was noted by the enthusiasm shown toward bettering the marks made at previous testing periods, as well as the satisfaction derived in the accomplishment of the activity.

A similar course could be conducted in the high school physical education programs and should prove valuable in the light of the aims and objectives set up by leading physical educators. According to Williams, the program should "consist of activities that are physically wholesome, mentally stimulating, and socially sound."

CHART A

	Height	Weight	Chins	Push-Ups	Jump and Touch	Tunnel—Head First 30 Feet	Tunnel—Feet First	Wall Climb	Rope Climb 18 Feet	Pole Climb 18 Feet	Ladder Climb 18 Feet	Sit-Ups	Hor. Ladder Rounds	Standing Broad Jump
Class Aver.	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range
Spring Term	5'4"–	127-	2-	5-	8'3"-	7.2-		6.5-	6.1-				10.9-	6'8"-
1942	6'2"	206	25	70	10'1"	17.6		19.1	18.4				18.0	9'5"
205 Cases														
Class Aver. Pre-testing			6.866	16.074	8'11½"	16.32 sec.	17.13 sec.	11.23 sec.	9.161 sec.				14.04 sec.	7'5.2"
Class Aver. After Training	5'9"	155.9	10.228	26.478	9'1"	14.48 sec.	16.05 sec.	9.89 sec.	9.06 sec.	8.279 sec.	8.43 sec.		13.06 sec.	8'0.6"
Aver. Increase After Training	.2"	1.5#	3.362	10.40	1.5"	1.84 sec.	1.08 sec.	1.34 sec.	.101 sec.				.98 sec.	13.8"
Per Cent Increase Over Pre-testing			32.87	39.29	.0146	11.31	.062	11.93	.011				.075	12.55"
Class Aver.	Range	Range	Range	Range	Range	Range		Range	Range			Range	Range	Range
Fall Term	5'4"-	120#-	3-21	5-53	8.0"-	7.4-		6.4-	6.0-			5-125	10.5	6.6"
1942	6'5"	216#			10.2	17.8		19.2	19.0				17.6	9.4"
260 Cases														
Class Aver. Pre-testing			7.2	17.34	8'11.4"	15.41 sec.		11.8 sec.	10.21 sec.			25.76	14.07 sec.	7'4.8"
Class Aver. After Training	5'10.1"	157.2	10.14	26.53	9'2.5"	14.11 sec.		9.1 sec.	9.13 sec.			46.21	12.63 sec.	8'4"
Aver. Increase After Training		1.2#	2.94	9.19	3.1"	1.3 sec.		2.7 sec.	1.08 sec.				1.44 sec.	8'4"
Per Cent Increase Over Pre-testing			28.98	34.64	.02.7"	.085		22.8	10.5			44.27	10.23	11.21

AVERAGES OF CHART A

	Height	Weight	Chins	Push-Ups	Jump and Touch	Tunnel—Head First—30 Feet	Tunnel—Feet First—30 Feet	Wall Climb	Rope Climb 18 Feet	Pole Climb 18 Feet	Ladder Climb 18 Feet	Sit Ups	Horiz. Ladder Rungs	Standing Broad Jump
Average Increase For Both Groups 468 Cases		1.35	3.151	9.79	2.3"	1.57 sec.		2.02 sec.	.58 sec.				1.21 sec.	12.5"
Per Cent Increase Both Groups		1.35	30.92	36.96	.0208	5.697		17.26	.554			44.27	5.15	11.88

Per cent increase = difference between the first and last reading divided by the first reading, expressed as a percentage.

A Critical Analysis of Achievements in the Physical Fitness Program for Men at Indiana University

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WHEN the faculty and board of trustees at Indiana University charged the men's department of physical education with the new physical fitness program, physical fitness was their primary objective. To this end one hour a day five days a week were devoted.

Normally the objectives of the department could be epitomized as follows:

1. Physical and organic growth and development
2. Development of social traits and qualities
3. Development of psychological or interpretive powers
4. Developing recreational capacity
5. Developing safety capacity

Due to the national and local pressures primary emphases have been placed upon motor fitness curricularly as well as in the program of measurement. Other desirable outcomes have been striven for but less directly and are not evidenced in these statistical data.

Previous to setting up the measurements program described below a survey was made of existing factor analysis studies. From them it was disclosed that the essential factors in successful performance in physical education activities are strength, velocity, motor fitness (ability), dead weight, height, and endurance in the order listed. The items analyzed below were chosen in light of these facts.

DESCRIPTIONS OF ITEMS AND PROCEDURES

This is the second achievement report. Since the first study was published new items have been included. The original items will be discussed first followed by a description of the added measures.

Brace Test.—The Iowa revision of Brace's test of motor ability consists of five matched pairs of stunts measured on the pass-or-fail basis. A possible score of 20 points can be earned by assigning two points for success on the initial effort, one point upon a second trial, and zero if the second trial is unsuccessful. The test is pupil-partner scored. Pencil, paper, and watch are the only equipment needed.

Burpee Test.—From a stand one squats on the floor, from there

he executes a front support. He returns to the squat and finally to a stand. This four part movement is repeated as many times as possible for ten seconds, giving one point for each complete exercise and ¼ for each part of the last exercise accomplished. No equipment is needed save pencils, paper, and watch.

General Motor Quotient.—McCloy's General Motor Capacity Test includes (1) Classification Index I, (2) The Sargent Jump (vertical jump), (3) Burpee Test, and (4) Brace Test (Iowa Revision). These items are weighted from tables in the author's book and their sum is divided by the norm in G.M.C. for the person's Classification Index. This fraction times one hundred is the General Motor Quotient. Jump boards suspended from basketball backstops have been found to be more effective than to jump against the wall. This event is squad-leader scored.

Chins.—The pull-ups were done from the high-bar with choice of grip allowed. A stout pole supported in the corner of a room would serve for the high bar. This event was squad-leader scored.

Push-ups.—The floor dips were pupil-partner scored. The chest was required to touch the floor each time.

Standing Broad Jump.—This event was done indoors on mats marked with chalk in 6-inch intervals. Squad leaders estimated to the *nearest three inches* and recorded.

Vertical Jump.—The jump-and-reach or Sargent Jump was measured on 6-foot plywood boards painted black. Magnesium chalk is needed for the fingers. It has been found that a yardstick is quicker than and practically as accurate as more complicated means of appraising the distance jumped.

ADDITIONAL ITEMS

(Third Semester Study)

Dips—Parallel bars were inclined to accommodate short or tall performers. The first mount counted one dip but no half credits were given. Wooden dipping bars can be easily built for less than ten dollars.

Larson's Dynamic Strength Test. Chins, dips, and vertical jump are weighted according to the author's scales. No new items are introduced in this measure.

Sixty-Yard Dash.—In this event runners were paired. The stop watch clocked the time of the first man. The time of the second man was taken by counting the number of 5 foot zones he was behind the winner. One-fifth second was added to the winner's time for each zone between the two men at the finish. Stop watch and squad cards were needed.

Quarter-Mile Run.—This event was run by squads of 8-10 men. All were started at the signal and the time to the second was called out as each man finished. Equipment same as for sixty-yard-dash.

Two-Mile Walk.—Walkers were required to always have one foot on the ground and to plant the heel first. The entire class was started at the same time. Care was taken to note the two or three persons who overlapped. (The quarter-mile track was covered eight times.) The time was announced for the leaders each lap and final time for each person was given to the nearest 5-second period.

Drop-Off Index.—This measure of endurance is obtained by dividing the time on the quarter-mile run by the time on the sixty-yard dash.

ADMINISTRATIVE GROUPING OF TEST ITEMS FOR INSTRUCTIONAL PURPOSES

Five days were required in the application of the fourteen measures involved in this report. The criteria for the inclusion of a test item were:

1. Validity to the objectives of the program.
2. Educational worth of the test as an activity.
3. Ease of administration.
4. Absence of expense in time or equipment.
5. Norms available if possible.
6. Utility of item in computation of combined measures.

All items were considered to be valid and educationally desirable and to meet most of the other criteria reasonably well. Items were organized together so as to get variety and to assure their accomplishment in the allotted time.

1st day.—Brace, Burpee, Push-ups, Age, Height, Weight.
2nd day.—Standing Broad Jump, Chins, Vertical Jumps, Dips.
3rd day.—"Test of a Man" and 60-yard dash.
4th day.—Two-Mile Walk.
5th day.—Regular class ending with quarter-mile run.

Additional tests computed from these items were general Motor Quotient, Larson's Strength Test, and the Drop-Off.

RATES OF ACHIEVEMENT BY ADVANCED CLASSES AS EVIDENCED BY AUGUST 10, 1942, TESTS IN INITIALLY UTILIZED MEASURES

(Final Gains are over a Five-Month Period)

1. Averages in the Brace Test over the four testing periods by the now advanced groups are 14.63, 16.24, 16.43, and 17.45, respectively . This is a total gain of 19 per cent in the five months. This was a gain of 6.70 per cent since the June 10 report.

2. Burpee Test averages similarly are 5.32, 5.96, 6.46, and 7.24. This indicates a gain of 36 per cent in the five months. A gain of 15 per cent since June 10 is indicated.

3. General Motor Quotient, a supposedly innate somewhat static measure shows the following series of averages: 97.30, 102.32, 102.5,

and 105.51. The total gain in five months is 8 per cent. There was a gain of 2.45 per cent since June 10.

4. In the chins (pull-ups) the averages were 7.02, 7.80, 7.85, and 8.82. A gain of 26 per cent is evidenced between the first and final testing periods. The actual gain is one and eight-tenths chins for the advanced population on the average. A gain since June 10 of 14 per cent is shown.

5. In the push-ups from the floor the averages were 16.88, 18.45, 17.20, and 21.53. A gain of 4.65 push-ups by the average advanced class member is 27 per cent better than his initial performance, or 25 per cent since June 10.

6. A gain of 8 per cent in the standing broad jump was attained by the following mean performances: 83.60, 84.65, 87.83, 90.47. This is actually an increment of 6.87 inches for the average advanced class member and a gain of about 3 per cent since June 10.

7. Vertical Jump gains of 15 per cent represent actual gains of 2.88 inches on the average achieved in this order: 18.82, 21.24, 21.20, and 21.70, by each advanced class member. This shows a gain of 2.35 per cent since June 10.

ACHIEVEMENTS OF BEGINNING, ADVANCED, AND TOTAL STUDENT GROUPS IN NEW ITEMS

In the dips on the parallels the gains for (1) beginning, (2) advanced, and (3) total classes were 38, 25, and 35 per cent, respectively. Over the beginning classes the advanced classes gained 2.32 chins or 48 per cent, the highest gain made on any item.

Larson Strength Test gains were similarly 9, 8, and 8 per cent, respectively (all per cents are rounded). Over the beginners a 14 per cent gain was made by the advanced group.

The 60-yard dash gains were 6, 2, and 4 per cent, respectively. The advanced pure gain being 7 per cent.

The quarter-mile run gains were 4, 1, and 1 per cent, respectively, the *smallest* gains of any item. Pure gain by the advanced group was 4 per cent.

Gains in the two-mile walk were 5, 2, and 4 per cent, with a pure gain of 2 per cent for the advanced classes.

Drop-off Index gains were 3, 4, and 4 per cent, and a pure gain of 4 per cent for the advanced classes.

The "Test of a Man" in which each item had as a standard "passable by 50 per cent of the group" was self-administered and this may have accounted in some part for the 81.2 per cent total effectiveness. In fairness to the boys, however, it should be said that all the items in the test were repeatedly thrown into the daily developmental calisthenic drills.

SUMMARY AND ANALYSIS OF GAINS IN TERMS OF THE OBJECTIVES OF THE PHYSICAL FITNESS COURSE

Strength of arms and total body	Per cent of Gain	Initial	Final	Standard
Chins	26	7.02	8.82	9
Dips	48	4.86	6.81	8.43
Push-ups	25	16.88	21.53	23
Larson Dynamic Strength Test	14	293.80	325.95	279
Velocity of Legs				
In time 60 yards	7	8.06	7.73	8.4
440 yards	4	68.60	66.79	70.4
In vertical distance (vt.j.)	15	18.82	21.70	19.25
In horizontal (st.br.j.)	8	83.60	90.47	90
Motor fitness (ability)				
Brace	19	14.63	17.45	15
Burpee	36	5.32	7.21	7
General Motor Quotient	8	97.30	105.51	100
Test of a Man	81.2%		81.2%	50%
Endurance				
440-yard run	4	69.60	66.79	70.4
Drop-off	4	9.09	8.74	
2-mile walk	2	23.75	23.28	22.66

RECOMMENDATIONS

1. Strength is being gained rapidly but is below standard, especially in the upper girdle work. More activities developmental of arms and shoulders should be included in the program.

2. In each velocity measure performance is above standard. This level should be at least maintained.

3. In motor fitness (ability) performances are all above standard.

4. Endurance gains are in each instance quite low and performance is generally below standard. The worst condition prevails in the 2-mile walk. Hiking should be adopted as originally planned and interspersed frequently. Gains *not made* cannot be measured. Endurance takes time and proper living is a necessary supplement.

5. All standards are made for ordinary circumstances. In war emergency physical fitness programs abundant gains must be sought.

6. The program is on the whole making quite commendable gains. However, these averages also indicate that fifty per cent of the students are below the indicated performances.

7. The significant differences in all events between groups indicate a need for (1) beginning, (2) intermediate, and (3) advanced classes in the future.

8. If statistical evaluation and guidance is to be continued, clerical assistance and time should be provided since the June and August statistical work required 164 hours and 104 hours, respectively, or a total of 268 hours, by the two statisticians alone. Future work will be simplified, however, since the basic data for comparison are now established.

STATISTICAL ANALYSIS AND RELIABILITIES
INITIAL TEST BATTERY

Test	Group	March 10	April 23	June 10*	August 10	Comparisons Between Test Periods					
						Fact	Mar-Apr	Mar-June	Mar-Aug	June-Aug	Norms
		M = 14.63±.096	16.24±.131	15.99±.10	17.31±.08	diff.	1.61	1.36	2.68	1.32	
Brace	Total	σ = 3.06	3.00	2.92	2.10	%	11	9	18	8	15.
		N = 1008	527	810	626	C.R.	9.88**	9.64	27.07	10.15	
				M16.43±.17	17.45±.09	diff.		1.80	2.82	1.02	
	Adv.			σ = 3.47	1.67	%		12	19	6	
				N = 424	311	C.R.		9.28	21.69	5.37	
		M = 5.32±.04	5.96±.05	6.27±.04	7.21±.04	diff.	.64	.95	1.89	.94	
Burpee	Total	σ = 1.36	1.18	1.03	1.03	%	12	18	36	15	7.
		N = 1007	5.23	800	633	C.R.	9.55	16.96	32.03	11.70	
				M = 6.46±.05	7.24±.04	diff.		1.14	1.92	.78	
	Adv.			σ = 1.00	.80	%		21	36	12	
				N = 420	318	C.R.		17.53	30.96	13.70	
Gen.		M = 97.30±.28	102.52±.37	100.3±.47	105.30±.30	diff.	5.22	3.00	8.00	5.00	
Motor	Total	σ = 7.52	8.00	10.27	6.96	%	5	3	8	5	100.
Quot.		N = 701	460	515	543	C.R.	10.63	5.48	19.51	9.09	
				M = 102.5±.78	105.51±.42	diff.		5.20	8.21	3.01	
	Adv.			σ = 12.81	6.96	%		5	8	3	
				N = 271	270	C.R.		6.27	16.29	3.46	
Chins		M = 7.02±.11	7.80±.14	7.15±.12	8.36±.14	diff.	.78	.13	1.34	1.21	
(Pull-	Total	σ = 3.24	3.28	3.18	3.47	%	11	2	19	17	9.
ups)		N = 896	573	694	615	C.R.	4.48	.81	7.61	6.50	
				M = 7.85±.17	8.82±.18	diff.		.83	1.80	.97	
	Adv.			σ = 3.24	3.42	%		12	26	12	
				N = 360	313	C.R.		4.11	8.14	3.77	
Push		M = 16.88±21	18.45±.31	16.03±.23	20.75±.29	diff.	1.57	—.85	3.85	4.72	
ups	Total	σ = 6.66	7.12	6.66	7.24	%	9	—5	23	29	23.
(Floor)		N = 1008	537	808	605	C.R.	4.22	—2.71	10.87	12.75	
				M = 17.20±.32	21.53±.43	diff.		.32	4.65	4.33	
	Adv.			σ = 6.70	7.32	%		2	27	25	
				N = 424	291	C.R.		.83	9.73	8.17	

Stdg.		M = 83.60±.27	84.65±.35	86.47±.31	88.96±.29	diff.	1.05	2.87	5.36	2.49	
Brd.	Total	σ = 8.16	σ = 7.92	8.13	6.90	%	2.39	7.00	14.11	6.07	
Jp.		N = 896	523	708	558	C.R.		4.23	6.87	2.64	
				M87.83±.40	90.47±.41	diff.	1	3	6	3	.90
	Adv.			σ = 7.65	7.04	%		5	8	3	
				N = 367	299	C.R.		8.76	14.31	4.71	
		M = 18.82±.08	21.24±.12	20.81±.11	21.45±.11	diff.	2.42	1.99	2.63	.64	
Vert.	Total	σ = 2.29	2.82	2.94	2.85	%	13	11	14	3	
Jp.		N = 806	583	710	618	C.R.	17.04	14.63	18.79	4.03	19.25
				M21.20±.15	21.70±.18	diff.		2.38	2.88	.50	
	Adv.			σ = 2.85	3.06	%		13	15	2	
				N = 367	3.02	C.R.		14.08	14.92	2.17	

* June 10 totals include freshmen and sophomores for first time.
** Critical ratios *not* corrected for similarity of groups.

STATISTICAL ANALYSIS AND RELIABILITIES

ADDITIONAL ITEMS—THIRD SEMESTER

Event or Test	June 10	August 10	Comparisons between Test Periods			Norm
			Fact	J.-Aug.	Groups* J.-Aug.	
Dips on Bars	M—4.86±.12	M—6.54±.15	Dif.	1.68	2.05	
Totals	σ—3.27	σ—3.75	%	35	46	8.43
	N—708	N—587	C.R.	8.52	8.91	
	M—4.49±.17	M—6.21±.20	Dif.	1.72		
Beginners	σ—3.21	σ—3.56	%	38		
	N—339	N—301	C.R.	6.43		
	M—5.43±.17	M—6.81±.25	Dif.	1.38	2.32	
Advanced	σ—3.27	σ—3.76	%	25	48	
	N—369	N—295	C.R.	5.11	8.38	
Larson's Strength	M—293.8±2.3	M—317.8±2.2	Dif.	23.95	32.95	
Totals	σ—62.10	σ—54.75	%	8	12	279.
	N—706	N—620	C.R.	7.46	8.26	
	M—284.8±3.3	M—310.4±3.2	Dif.	25.59		
Beginners	σ—61.65	σ—56.00	%	9		
	N—341	N—310	C.R.	5.55		
	M—302.8±3.1	M—325.9±2.9	Dif.	23.20	41.15	
Advanced	σ—58.28	σ—52.50	%	8	14	
	N—365	N—310	C.R.	5.45	9.20	
60-*Yard Dash*	M—8.06±.02	M—7.77±.02	Dif.	.29	.56	8.4″
Totals	σ—.60	σ—.48	%	4	7	
	N—690	N—552	C.R.	10.32	15.55	
	M—8.33±.03	M—7.81±.03	Dif.	.52		
Beginners	σ—.60	σ—.51	%	6		
	N—328	N—255	C.R.	12.09		
	M—7.91±.03	M—7.73±.02	Dif.	.18	.60	
Advanced	σ—.63	σ—.41	%	2	7	
	N—362	N—297	C.R.	5.00	16.66	

440-*Yard Run*	M—68.6±.29	M—67.99±.26	Dif.	.61	1.61	70.4″
Totals	σ—7.4	σ—5.80	%	1	2	
	N—673	N—510	C.R.	1.60	3.93	
	M—69.6±.32	M—67.12±.35	Dif.	2.48		
Beginners	σ—5.76	σ—5.34	%	4		
	N—324	N—235	C.R.	5.27		
	M—67.8±.33	M—66.79±.30	Dif.	1.01	2.81	
Advanced	σ—6.24	σ—4.94	%	1	4	
	N—349	N—275	C.R.	2.30	6.53	
2-*Mile Walk*	M—23.80±.10	M—22.97±.09	Dif.	1.17	.78	22.66
Totals	σ—2.57	σ—2.17	%	4	3	
	N—660	N—510	C.R.	9.00	5.20	
	M—23.75±.12	M—22.60±.14	Dif.	1.15		
Beginners	σ—2.08	σ—2.01	%	5		
	N—304	N—237	C.R.	6.76		
	M—23.84±.14	M—23.28±.14	Dif.	.56	.47	
Advanced	σ—2.69	σ—2.25	%	2	2	
	N—356	N—273	C.R.	2.95	2.61	
Drop-Off (*endur.*)	M—9.12±.02	M—8.74±.03	Dif.	.38	.35	8.40?
Totals	σ—.57	σ—.68	%	4	4	
	N—601	N—465	C.R.	9.74	7.61	
	M—9.09±.03	M—8.83±.05	Dif.	.26		
Beginners	σ—.56	σ—.70	%	3		
	N—287	N—213	C.R.	4.48		
	M—9.15±.03	M—8.74±.04	Dif.	.41	.35	
Advanced	σ—.60	σ—.65	%	4	4	
	N—314	N—252	C.R.	7.74	6.73	

*All group gains in this column are compared with beginners' initial test.

MODIFIED CURETON'S "TEST OF A MAN"

Number of students—425

Items	Standards	Pass %	Rk. Diff.
1. Recovery from Dizziness	Walk 10 steps in 6 in. path	69.3	2
2. Breath Holding after Strenuous Activity	30 seconds		
3. Standing Broad Jump	7 feet	89.1	8
4. Victory Flexion	20 seconds	97.0	12
5. Foot and Toe Balance	20 seconds (10 each)	92.0	9
6. Extension Bridge	Once for 4 inches	33.9	1
7. Trunk Flexion	8 inches	81.2	5
8. Push Ups	24	71.0	3
9. Stiff Body Lay-Out	20 seconds	95.9	10
10. Trunk Extension	20 inches	86.3	7
11. Man Lift and Let Down	± 10 lbs. of own weight	96.6	11
12. Squat Stand (Tip-up for time)	10 seconds	74.6	4
13. Perpetual Motion Alternate Leg-Shift and Sit-Ups	20 each	85.4	6
Total		81.2	

*All group gains in this column are compared with beginners' initial test.

Classified, Annotated List of Available Films on Riding, Horses, and Subjects Pertaining to Horses

By Phyllis Van Vleet

University of California
Berkeley, California

CAVALRY AND MOUNTED POLICE

Closing Ceremonies and Equestrians, 16 mm., No. 3, "Official Olympic Film." (C)

Life of O'Riley, (1) 16 mm., si., No. 26, "Training United States Cavalry officers and mounts at Fort Riley, Kansas." (G)

Man on Horseback, (1) 16 mm., sd., No. 11, "Story of mounted traffic policemen; training police horses and horses in action; safety rules for pedestrians." (G)

Riders of Riley, (1) 16 mm., sd., No. 19, 5, 22, "Horsemanship by cadets." (C) (E) (G)

BREEDS AND TYPES OF HORSES

Horses, (1) 16 mm., sd., No. 7, 43; 16 mm., sd. and 16 mm. si., No. 9, 12, 27, 29; 16 mm., si., No. 31, "Shows wild horses, thoroughbreds, cavalry horses; races, hunts and events of horsemanship." (G)

Horse and Man, The, (1) 16 mm., si. and 35 mm., si., No. 38; also Nos. 1, 6, 39; "Horse's part in conquest of the New World and in modern American life; various kinds of horses." (B) (G)

Horse Power in Action, (1) 35 mm. sd., No. 21, "Work and pleasure horses in action." (G)

"If Wishes Were Horses . . ." (2) 16 mm. si., Kodachrome, No. 41 (1938); "This is a presentation of four types of horses used in this country today: the hunter, the saddle horse, the school horse, and polo pony. Each is shown without tack for general conformation and with tack showing gaits, etc." (E)

Judging Percherons, (1) 16 mm. sd., No. 4a, 22 (1940) "Photographed principally at famed Lynnwood Farm, near Carmel, Indiana, it records the visit of a party of students who review a class of Percheron mares and are enabled to compare their own observations and placing with those of an able judge." (B)

Kentucky Thoroughbreds, (1) 35 mm. sd., No. 35, 42, "Facts about famous

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This article submitted by the Publications Committee of the National Section on Women's Athletics.

Key to Film Bibliography:

"Film title; number of reels in parenthesis; size of film, i.e., 16 mm. or 35 mm; silent (si.) or sound (sd.); number referring to distributor. list of which may be found at end of article; annotation; letter referring to sources for film bibliography—(see below).

Key to Sources for Film Bibliography:

A. *Catalogue of Films for Classroom Use,* Teaching Film Custodian, Inc., 25 West 43rd Street, New York City.

B. *Education Film Catalogue,* Dorothy Cook and Eva Cotter Rahbek-Smith, H. W. Wilson Company, New York, 1936, 1937, 1938, 1939, 1940-41 (2-year supplement).

C. *Motion Pictures in Health and Physical Education,* Hughes and Stimson, *Research Quarterly,* A.A.H.P.E.R., Vol. IX, March, 1938.

D. *Motion Pictures for Instruction,* A. P. Hollis, The Century Co., New New York, 1926.

E. *Motion Pictures in Sports,* Motion Picture Committee of the N.S.W.A., A.A.H.P.E.R., Washington, D. C., including supplement, March ,1940.

F. *Motion Pictures of the United States Department of Agriculture,* Miscellaneous Publication No. 451, Washington, D. C., November, 1941.

G. *1000 and One,* The Educational Screen, Chicago, Ill., 1935-36, 1936-37, 1937-38, 1939-40, 1940-41, 1941-42.

horses and their breeding in the Blue Grass Country." (G)

King of the Sierras, (4) 16 mm. sd., No. 5, 35a (1938) "The story of wild horses on the plains and their struggle for free existence before the encroachment of their enemy, man. A simple and disarming picture of natural charm against a wide background of pine valleys and lakes. The rearing of a little colt by his father, the leader of the herd; showing him the dangers to be avoided and the little animals with whom to make friends, rescuing him when lost and defending him from a pack of wolves." (B)

Kingdom for a Horse, (1) 16 mm. sd., No. 5, 35a, 36a, 44 (1940) "Old Dobbin tells the story of his high- and low-born relatives—the blue ribbon high stepper, polo ponies, race horses, hunters, trotters, jumpers, bucking broncs, and even the almost extinct fire horse." (B)

Royal Steeds, (1) 16 mm. sd., No. 19, "Lively picturization of the world's most famous breeds. Bill Corum." (G)

Three and Five-Gaited Saddle Horse, (1) 16 mm. si., No. 39a, "Designed to familiarize the student with the recognized saddle-horse type and gaits. Closeups and slow-motion photography emphasize correct details." (B)

Today's Horse Farm: Sun-up to Sundown, (1) 16 mm. sd., Kodachrome, No. 17a (1941) "The film opens with Bonnie, a champion white draft horse, and her stable mate, Black Mammy, poking their heads out of their stable windows eager for the day to start. It follows these two and their colts through the day in their contacts with men and with other horses. . . ." (B)

TRAINING

Blue Grass Kings, (1) 16 mm. sd., No. 19, "Racing horses in training and action." (G)

Bugles from the Blue Grass, (1) 16 mm. sd., No. 17, 19, "Portrays the work and care necessary in the raising of race horses." (G)

Harnessed Rhythm, (1) 16 mm. sd., No. 37, "The care and training of race horses with discussion of the equipment for the horse and sulky." (A)

Horse, (1) 16 mm. sd., 35 mm. sd., No. 16a, 40a (1941), "After showing the role of the horses in modern life, the film follows the development and training of a colt from one week to three years of age in the Blue Grass country of Kentucky. A horse breeder, his granddaughter and a trainer minister to the needs of the colt, Prince, who is training for the walking, trotting and cantering gaits before appearing in a horse show shortly after his third birthday." (B)

Horse in Motion, The, (1) 16 mm. si. and 35 mm. si., No. 38; also No. 13, 40, "Study of various gaits of horses, at normal speed and then analyzed by slow-motion photography." (B; (G)

Horse Raising, (1) 16 mm. sd., Kodachrome, No. 17a (1941), "A prospective buyer arrives to look over the horses on a large horse farm. The points of a fine horse are brought out: good head, chest, back, hind-quarters, and legs and the horses are put through their paces in the ring. Percherons, Standard Bred Trotters, Belgian, Tennessee Walking Horses and Arabians are exhibited. Breeding of fine stock as as well as of mules is discussed. The importance of proper treatment and training is stressed. The veterinarian arrives on his regular visit. The film shows that a horse should be well-housed, fed, shod, harnessed, and driven. The importance of correct bits, bridles, and harness is brought out. A horse is properly saddled. An eight-horse wagon hitch is prepared for the country fair. The grooming, braiding, decorating, and harnessing of these magnificent white horses is done with meticulous care." (B)

King of the Turf, (1) 16 mm. si., No. 10, "Shows many famous race horses." (G)

Timber Toppers, (1) 16 mm. sd., No. 37, "Training a horse to jump. The picture opens with close-ups of Bartender, a champion jumper, and his trophies." (A) (E)

Trained Hoofs, (1) 35 mm. sd., No. 28, 16 mm. sd., No. 37, "The care and training of a colt from its birth to its first race. This picture includes close-ups of Sir Galahad III, Crusader, and Man-O'-War. A group of horsemen examine a newborn colt in the stables. A sick colt is cared for. A young horse is introduced to bridle and bit. Later he is slowly broken to the saddle. The committee's comment is: 'Recommended as good informative material in all grade levels on how race horses are trained.'" (A) (G)

Training a Roping Horse, (1) 16 mm. si., sd., No. 5, "Produced by the Educational Division of Seeanay films. While we gaze at rodeo scenes the commentator explains that such stunts as are here viewed are actually needed in the everyday life of a cowhand. . . . Then we see a cowboy who knows his job thoroughly. He instructs youngsters in throwing a lariat. We see various mounts and then shots of cowboys training their horses." (B)

Trotting Thoroughbreds, (1) 16 mm. sd., No. 37, "Another picture on the training of race horses. The Committees comment is: 'While the subject of this picture is not related to the curriculum in any direct way, it is included in this catalogue on the theory that social studies may review the history of the county fair, a traditional and important institution in American life. The trotting races were the climax of the country fairs.'" (A)

POLO

Polo, (1) 16 mm. sd., No. 37, "'Recommended by the Committee for all grades through college.'" (A)

Sport of Kings, The, (1) 16 mm. si., No. 30, "Grand National Steeplechase, Polo Games." (C)

Swinging Mallets, (1) 16 mm. sd., No. 37, "The Committee's comment is: 'Probably the best picture on polo, but its use, of course, is limited.'" (A)

WESTERN

Action, (1) 16 mm. si. and 35 mm. si., No. 16, "Wild horse and pony express races, 'bulldogging', trick riding and roping." (G)

Dude Ranch Vacations, (1) 16 mm. si. and 35 mm. si., No. 33, 36, 44, "Life on dude ranches." (G)

Hoot Gibson Rodeo, (1) 16 mm. si., No. 1, "Fast-moving film of cowboys and cowgirls, broncho busting, steer-riding, etc." (C)

Kildeer Rodeo, (3) 35 mm. si., No. 18, "Annual roundup at Kildeer Mountains, N. D." (G)

Let 'er Buck, (1) 16 mm. sd., No. 5, 19, 23, "A Western rodeo; broncho-busting, calf-roping, bulldogging steers, etc." (G)

News Reel Thrills, (1) 16 mm. sd. and 35 mm. sd., No. 2, "Action picture. Champion log rollers, broncho busting, steer roping, tractor racing, etc." (G)

Ranch Holiday, (1) 16 mm. si., and 35 mm. si., No. 33, 36, "Life on Dude Ranches." (G)

Real Rodeo, (¼) 16 mm. si., No. 14, "The Pendleton Roundup." (G)

Ride 'em Cowboy, (1) 16 mm. si. and 35 mm. si., No. 44, "Cheyenne Frontier Days Celebration; fancy stunt riding, calf roping, etc." (G)

She's Wild, (1) 16 mm. si. and 35 mm. si., No. 38; 16 mm. si., No. 1, "Cowboys on cattle ranges; 'broncho busting'; roping and tying and other exhibitions." (C) (G)

Sky High Stampede, (1) 16 mm. si., No. 1, "Rodeo time. Parade, Indians, floats, with cowboys and cowgirls all in action." (C) (G)

Story of a Horse, (1) 16 mm. si., sd., No. 15a, "Life of a wild horse on western range." (F)

Tenderfoot Trails, (1) 16 mm. si. and 35 mm. si., No. 44, "Experiences of a party of tourists vacationing on a 'Dude Ranch' in the Canadian Rockies." (G)

Trail Riders of the Wilderness, (2) 16 mm. si., 35 mm. si., No. 38, "The

record of an American Forestry Association tour of primitive areas of the Flathead and Lewis and Clark National Forests. Members of the party motor by bus from Missoula, Mont., to a base camp where they are supplied with horses, a pack train, camping equipment, and guides. Shows the many points of interest covered by the party on a 10-day riding trip over trails leading to the South Fork and Sun River areas of western Montana." (F)

Ups and Downs of a Broncho Buster, (1) 16 mm. si. and 35 mm. si., No. 33, 36, "Rodeo Thrills." (G)

Western Whoopee, (1) 16 mm. sd., No. 5, "Wild West Sports." (G)

When Winter Comes to the Range, (¼) 16 mm. si., No. 5, 7, "Vivid picturization of hardships suffered by man and beast when a blizzard strikes the range." (G)

Where the West is Still West, (1) 16 mm. si., No. 5, 7, "Round up riding and pastimes on the ranges." (C) (G)

Wild West, (¼) 16 mm. si., No. 20, 32, "Broncho busting, roping and riding thrills." (G)

World Famous Rodeo, The, (¼) 16 mm. si., No. 5, "Wild-west stunts at Pendleton, Oregon." (G)

INSTRUCTIONAL

Ground Technique, (2) 16 mm. si., No. 39a, "Proper methods of saddling and bridling a horse, mounting, position on horse, turning, backing, dismounting, and leading are demonstrated. Close-ups and slow-motion photography emphasize correct details." (B)

Riding Technique, (1) 16 mm. si., No. 39, "This reel presents 'The English Style of riding the three common gaits.' Close-ups and slow-motion photography emphasize correct details." (B)

Saddle Sense, (2) 16 mm. si. Kodachrome, No. 41 (1940), "An instructional film based on approved fundamental techniques of horsemanship, produced especially for use in schools and colleges."

MISCELLANEOUS

Horses and Bots, (2) 16 mm. si. and 35 mm. si., No. 38, "Three types of bot-flies, how they attack horses and mules; methods of treatment; eradication campaigns.' (F)

Maverick, The, (1) 16 mm. si. and 35 mm. si., No. 29, 35 mm. si., No. 35, "Autobiography of a Horse." (G)

Sport Parade, 16 mm. si. and 16 mm. sd., No. 1, 14, 23; 16 mm. si., No. 4, 24, "One part—one of the subjects called 'Horses'—or a larger series." (B)

Stable Flies and Their Control, (1) 35 mm. si., No. 38, "Methods of protecting animals from the stable fly and preventing breeding of pests." (G)

KEY TO DISTRIBUTORS

1. Akin and Bagshaw, Inc., 1425 Williams Street, Denver, Colorado.
2. Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin.
3. American Olympic Association, 233 Broadway, New York City.
4. Anderson Supply Company, Inc., 111 Cherry Street, Seattle, Washington.

4a. Atlas Educational Film Co., Oak Park, Illinois.

5. Bell and Howell Co., 1801 Larchmont Avenue, Chicago, Illinois.
6. Brigham Young University, Bureau of Visual Instruction, Provo, Utah.*
7. Burton Holmes Films, Inc., 7510 North Ashland Avenue, Chicago, Illinois.
8. Carter Cinema Producing Corporation, in care of Evans Laboratories, 1476 Broadway, New York City (not listed).
9. Castle Films, R.C.A. Building, New York City.
10. Central Camera Company, 230 Wabash Avenue, Chicago, Illinois.
11. Chevrolet Motor Co., Advertising Department, Detroit, Michigan.
12. Cosmopolitan Film Libraries, Inc., 3248 Gratiot Avenue, Detroit, Michigan.

13. Dudley, William H., Visual Education Service, Inc., 736 South Wabash Avenue, Chicago, Illinois.
14. Eastman Kodak Co., "Kodak Cinegraphs," Rochester, New York.
15. Eastman Kodak Stores, Inc., 356 Madison Avenue, New York City.
15a. Edited Pictures System, Inc., 330 W. 42nd St., New York City.
16. Educational Films Corporation (primarily theatrical), 1501 Broadway, New York, N. Y.
16a. Erpi Classroom Films, Inc., 35-11 Thirty-Fifth Ave., Long Island City, N. Y.
17. Film Library of New England, 239 Columbus Avenue, Boston, Massachusetts.
17a. Frith Films Co., Box 565, Hollywood, Cal.
18. Gibson Studios, Casselton, North Dakota.
19. Gutlohn, Walter O., Inc., 35 West 45th Street, New York City.
20. Hollywood Film Enterprise, Inc., 6060 Sunset Boulevard, Hollywood, Cal.
21. Horse and Mule Assoc., 407 South Dearborn Street, Chicago, Illinois.
22. Ideal Motion Picture Service, 6 St. John's Avenue, Yonkers, N. Y.
23. Ideal Pictures Corporation, 30 East Eighth Street, Chicago, Illinois.
24. Kaltman, L. and Sons, Inc., 305 Washington Street, Newark, N. J.
26. Kodascope Libraries, Inc., 33 West 42nd Street, New York City.
27. Lewis Film Service, 224 North Market Street, Wichita, Kansas.
28. Metro-Goldwyn Mayer (primarily theatrical), 1540 Broadway, New York City.
29. Metropolitan Motion Picture Company, 50 Branford Place, Newark, N. J.
30. Mogull Bros., 1933 Boston Road, New York City.
31. National Cinema Service, 3 West 29th Street, New York City.
32. National Motion Picture Company, Mooresville, Indiana.
33. Northern Pacific Railway, Passenger Traffic, St. Paul, Minnesota.
35. Pinkney Film Service, 1028 Forbes Street, Pittsburgh, Pennsylvania.
35a. Post Pictures Corporation, 723 Seventh Ave., New York City.
36. Ray-Bell Films, Inc., 2269 Ford Road, St. Paul, Minnesota.
36a. Skibo Productions Inc., R. 715, 1270 Sixth Ave., New York City.
37. Teaching Film Custodians, 25 West 43rd Street, New York City.
38. United States Department of Agriculture, Division of Motion Pictures, Washington, D. C.
39. University of California, Extension Division, Berkeley, California.
39a. University of Minnesota, Extension Division, Minneapolis, Minnesota.
40. University of Missouri, Visual Education Department, Columbia, Missouri.
40a. University of New Hampshire, Extension Service, Durham, New Hampshire.
41. Van Vleet, Phyllis, Department of Physical Education for Women, University of California, Berkeley, California.
42. Wholesome Films Service, Inc., 48 Melrose Street, Boston, Massachusetts.
43. Williams, Clem, Films, 410 Diamond Bank Building, Pittsburgh, Pennsylvania.
44. Y.M.C.A., National Council of, Motion Picture Bureau, 347 Madison Avenue, New York City.

There are many other Visual Education Departments in college and universities that may be distributors for the films listed.

The Relation of Selected Structural and Functional Measures to Success in College Athletics

By Vincent DiGiovanna, Ph.D.

Southern Illinois Normal University
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OF fundamental importance to any guidance program in physical education is a thorough knowledge of the factors that make for athletic success. Many elements are recognized as contributing to achievement in athletic activities. If the entire gamut of these integrants could be measured objectively the results in their summation would indicate the patterns or types of individuals who succeed or fail in athletics.

Of the many variables involved in the ability to succeed in athletics not the least important appear to be those of body structure, muscular strength, and explosive power. Yet even here relatively little research has been done. Furthermore, while in the field today one can find several excellent tests of general athletic ability and many more tests of achievement in specific sports based on the skills involved therein, nowhere, except to a limited degree, is there to be found any group of raw measures used as predictors of ability in specific sports.

STATEMENT OF THE PROBLEM

The purpose of this study is to add to the knowledge of the relationship of factors of body build, muscular strength, and explosive power to success in college athletics. The problem is to determine the relation of selected structural and functional measures to success in each of several sports; namely, baseball, basketball, football, gymnastics, tennis, and track and field, and to ascertain if there are patterns or combinations of these measures which are associated with such success.

For the sake of more detailed information football was divided into backfield and line, and each division was investigated as an independent unit. Track and field was also divided so that the weight men, that is, the shot-putters and discus throwers, were studied as one unit and the remainder of the participants as another. Five additional athletic groups were examined to discover further information on the general question of the relation of selected measures to success in athletics. These involved a One-Sport Group (athletes who participate in only one sport), a Two-Sport Group (those competing

in two sports), a Three-Sport Group (those competing in three sports), a Total Athletic Group ,and a Non-Athletic Group.

In this study the term *athlete* indicates an individual who is a member of a varsity sport traveling squad[1]; structural measures refer to a group of skeletal and girth measurements of the human body; and functional measures are interpreted in terms of muscular strength and power, in which strength is thought of as the ability of the major muscle groups to overcome resistance as measured by dynamometers, and power as the effective speed application of this strength as suggested by the mechanical principle that power equals force times velocity.

PROCEDURE AND ANALYSIS OF DATA

The test items selected for study are as follows:

1. *Structure.*—Weight, standing height, sitting height, shoulder breadth, chest breadth, chest depth, hip breadth, arm span, and arm girth. Leg length was also investigated directly where the data seemed to indicate that it might be of importance.

2. *Strength.*—Right grip, left grip, back force, leg force, arm-pulling force, arm-pushing force, and total force. (These comprise the test items of the MacCurdy Force Test.)

3. *Power.*—The Vertical Jump (height attained minus standing height) and the MacCurdy Physical Capacity Index (Force Index times Vertical Jump $\div$ 100).

The subjects were college men between seventeen and twenty-four years of age, who had been determined fit to participate in the regular program of physical education by medical examination. The subjects originated from three sources.

The basic data involved 836 students, including 102 athletes, from the Southern Illinois Normal University. The number of students closely approximated the total male population. A sampling of 95 athletes from three additional Illinois state teachers' colleges, located at Charleston, Macomb, and Normal, were grouped together and studied as supplementary data. An additional investigation was also made of a group of 13 gymnasts from the University of Illinois and the University of Minnesota. These supplementary data were used to suggest whether or not the basic findings might possibly have general implications.

The objectivity of the tests was determined by computing the product moment coefficient of correlation of single measurements made independently on the same group of subjects by the trained examiners used in the study and the investigator. It may be noted in Table I that the objectivity of the tests is acceptably high. The structural measures yielded correlations ranging from .92 to .999 and the functional tests yielded correlations from .80 to .95.

[1] That select group of individuals which represents the institution in out-of-town athletic competition.

TABLE I

OBJECTIVITY OF THE TESTS

	26 Cases**		
	r	SD*	PEr
Weight	.999	23.70	.0003
Height	.999	2.94	.0003
Sitting Height	.99	1.24	.0026
Shoulder Breadth	.97	2.47	.0078
Chest Breadth	.96	4.13	.0104
Chest Depth	.92	3.28	.0203
Hip Breadth	.96	2.04	.0104
Arm Girth	.997	6.09	.0008
Arm Span	.998	3.76	.0005
Vertical Jump	.94	2.68	.015
Right Grip	.90	20.38	.025
Left Grip	.80	19.56	.048
Back Force	.83	65.37	.041
Leg Force	.87	306.51	.032
Arm Pull	.89	78.82	.028
Arm Push	.82	40.21	.043
Total Force	.92	475.10	.020
P. C. I.	.95	138.80	.013

* Standard Deviations of the first group of measurements taken.

** The normal group of students was used as the basis of comparison in this study. In order to help insure "random" selection within the twenty-six cases used to determine the objectivity of the measures, the Cozens Height-Weight Classification Scheme for College Men (*Research Quarterly*, March, 1930, pp. 39-45) was utilized as a rough guide. The test cases were selected on a voluntary basis so that they roughly conformed to the nine height-weight classes, and the distribution therein, described by Cozens. In this way, from a structural standpoint at least, a relatively normal spread within this sample of cases was assured. It was rather expected that the same would hold true functionally.

In the analysis of data the critical ratio, the index of significance[2] and the standard score comparison techniques were employed. Each of these statistical manipulations was used to determine differences between the measurements of the specific athletic groups and the normal group. The latter group was composed of all the cases in the basic data. A critical ratio of 2.00 was accepted in this study as indicative of a real difference.

The index of significance technique was employed to denote the magnitude of the differences between the groups as opposed to

2 This technique is a variation of the usual critical ratio formula which gives a mathematical statement of the difference between groups both as to their averages and as to the distribution of the individuals around the averages. It permits due consideration of the overlapping of the groups and overcomes the relative effect of the various dichotomous splits made in the population when comparing the athletic groups with the normal group. It expresses the standard differences which would be obtained if paired comparisons were used having equal populations in each of the two groups compared. This statistical method has been referred to as An Index of the Relative Significance of a Series of Differences. For further description of the technique see R. Franzen, *An Evaluation of School Health Procedures*, pp. 35-41, 106-108.

merely the chances that real differences existed. The interpretation of indices of significance of various magnitudes was set arbitrarily for this study as follows: from .00 to ±.50 denotes small or negligible difference; from ±.50 to ±1.00 denotes moderate or substantial difference; and from ±1.00 and above denotes great to very great difference.

Standard scores in the test elements were computed for the individuals in each athletic group. These were arranged in rank order and plotted graphically to show by inspection both the degree of normality of distribution within each group and the general differences among the groups.[3]

RELATION OF THE MEASURES TO SUCCESS IN SPECIFIC SPORTS

The critical ratios presented in Table II show the significance of the mean difference in the test variables between each athletic group and the normal group. The indices of significance indicated in Table III reveal the magnitude of the differences between each athletic group and the normal group.

Baseball.—The successful baseball players[4] exhibit real differences from the normal group in four structural items, three strength measurements, and in both power traits, as shown in Table II. They are shorter in height, in sitting height, in arm span, and have larger arm girths. They have a stronger arm pull, stronger legs, and a greater total force. They are more powerful as measured both by the vertical jump and the Physical Capacity Index[5] (referred to hereafter as P.C.I.).

On further investigation of the magnitude of these differences it was found that of the structural items only arm girth with an index of .56 shows a difference of any significant size as shown in Table III. Such an index discloses that the baseball players have a substantially larger arm girth than the normal group of students. Height, however, with an index of —.48, closely approximates substantial significance, and shows that these athletes are moderately shorter than the average student. Both the arm pull and total force measurements indicate differences of moderate magnitude in favor of the athletes. This is also true of the two measures of power although vertical jump has an index of only .48. Arm span and leg force, with respective indices of —.44 and .42 may possibly contribute in small measure to success in this activity.

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3 For these standard score tables and graphs see V. DiGiovanna, *The Relation of Selected Structural and Functional Measures to Success in College Athletics*, Appendix, pp. 129-156.

4 An All-Star team selected from an intramural baseball league of 179 players in the basic source of data where varsity baseball is not supported.

5 A description of the test items may be found under Procedure and Analysis of Data near beginning of article.

Within the limits of these basic data and experimental conditions, the findings indicate that individuals who succeed in college baseball tend to exhibit substantial differences from the normal group of students in two structural items, two strength measurements, and in both power traits. They are shorter in height and have larger arm girths. They have a greater arm pull, greater total force, and are more powerful.

Basketball.—The critical ratio technique reveals that the successful basketball players exhibit real and positive differences from the normal group in all the test elements of structure, strength, and power except back force and arm push.

Further investigation, by means of the index of significance formula, reveals that these athletes are differentiated from the normal group by having much more explosive power; by being substantially larger in weight, height, sitting height, leg length, shoulder breadth, chest depth, and arm span; and by having substantially greater arm pull and leg strength. The remaining real differences mentioned above have indices of significance ranging between .37 and .47 indicating that they may make some small contribution to success in the activity. The structural measurements also disclose that these athletes are relatively symmetrical. A comparison of height and sitting height, with respective indices of .80 and .52, however, intimates that, of the two components of height, namely sitting height and leg length, leg length is slightly more important. (Actual calculation shows this is verified by an index of .76 for leg length).

It is commonly accepted that height plays an important role in basketball success. The results herein tend to verify this common belief as is indicated both by an index of .80 for height and by the fact that the basketball players were found to be the tallest group of athletes measured. The results also indicate, however, that weight is equally if not more important than height. With this particular group of athletes it seems reasonable to believe that while weight may be important it probably is important more as a reflection of height than as weight itself. The slightly higher index for weight than for height (and this is true to a greater extent in the supplementary data) probably signifies that the basketball players have an average to a slightly better than average muscular development for their height.

These findings are supported in part by the results of recent, related studies. Bookwalter quoted an original unpublished study[6] in which he found that successful college basketball players tend to

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[6] K. W. Bookwalter, *A Critical Evaluation of the Application of Some of the Existing Means of Classifying Boys for Physical Education Activities.* Doctoral Dissertation (New York: New York University, 1938) p. 38.

be either tall-heavy or tall-medium. Beall found[7] that successful college women basketball players have longer arms and wider shoulders than the unsuccessful players. Hinton and Rarick reported[8] correlations of .55, .45, and .38 between arm, back, and leg strengths and basketball achievement of college women, whereas this study with college men found that while arm pull and leg force apparently made significant contributions to basketball success, arm push, and back force did not.

Football-Backfield.—As noted in Table II there are real differences between the successful football backfield men and the normal group in all the functional measurements and in four structural traits. The structural differences appear in weight, chest breadth, chest depth, and arm girth. In all these characteristics the athletes show the larger measurements.

Further inquiry into these differences by means of the index of significance method reveals that leg force and total force yield indices of .96 and .97 respectively which closely approximate great magnitude. This indicates that the football backs are substantially stronger in these respects than the normal group. P.C.I., one of the power measures, shows an index of 1.05 as contrasted with a .64 for vertical jump, the other power measure used in the experiment. This denotes that the strength factor contributes somewhat more than that of speed to the success of this particular group. Both strength and speed, however, make substantial contributions to the same.[9] With the exception of right and left grips, with indices of .33 and .46 respectively, all the remaining differences indicated above yield indices of substantial magnitude. This shows the football backs to be moderately larger in weight, chest breadth, chest depth, and arm girth; and moderately stronger in back force, leg force, arm pull, and arm push than the normal group.

In summary it may be said that the results obtained from this group indicate that the type or pattern of individual who succeeds as a college football back is one who is moderately larger than the normal individual in weight, chest breadth, chest depth, and arm girth; substantially stronger in leg force, total force, back force, arm pull, and arm push; and who has a substantially better vertical jump, and a much greater P.C.I. Roughly this individual might be characterized as moderately heavier and stronger, and much more powerful than the average student.

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7 E. Beall, *The Relation of Various Anthropometric Measurements of Selected College Women to Success in Certain Physical Activities*, p. 32.

8 E. A. Hinton, and L. Rarick, "The Correlation of Roger's Test of Physical Capacity and the Cubberly and Cozens Measurement of Achievement in Basketball," *Research Quarterly*, XI (Oct., '40) pp. 58-65.

9 Conferences with the coaching staff revealed that this sample of backfield men was somewhat slower than the usual group, in which case vertical jump might be expected to show even greater significance than is indicated here.

TABLE II

SIGNIFICANCE OF MEAN DIFFERENCES BETWEEN EACH ATHLETIC GROUP AND THE NORMAL GROUP IN STRUCTURAL AND FUNCTIONAL MEASUREMENTS*

	Baseball	Basketball	Football Backs	Football Line	Gymnastics	Tennis	Track and Field**	Shot and Discus	Non-Athletic Group	One-Sport Group	Two-Sport Group	Three-Sport Group	Total Athletic Group
Weight	1.65	5.85	3.56	10.92	—.18	.82	2.30	8.35	—1.65	4.95	2.65	4.60	6.11
Height	—2.59	4.64	—.24	2.74	—4.15	1.32	3.43	2.79	.83	1.38	1.45	2.03	2.31
Sitting Height	—2.50	4.00	.87	3.44	—.53	—.24	2.73	1.61	.00	.67	2.31	1.86	2.14
Shoulder Breadth	.95	3.24	1.08	4.42	1.28	.65	1.79	4.06	—1.11	2.78	1.11	2.88	3.33
Chest Breadth	1.76	2.63	3.75	5.44	1.05	—1.35	1.18	5.79	—1.11	3.51	2.17	2.17	4.41
Chest Depth	1.94	4.33	4.91	5.82	—.95	1.05	2.45	4.61	—1.25	3.24	4.13	3.56	4.84
Hip Breadth	—1.03	2.50	1.18	4.71	—3.33	1.22	.69	2.61	.00	2.35	.78	1.40	2.50
Arm Girth	3.62	2.63	4.25	7.93	3.85	—.43	.39	4.94	—1.60	4.75	3.53	2.26	5.85
Arm Span	—2.94	3.42	—.98	2.19	—2.14	.16	3.40	3.67	.00	2.26	.57	2.03	2.76
Vertical Jump	2.38	7.07	3.60	2.47	8.15	.48	6.00	1.31	—1.88	5.28	5.81	3.33	7.27
Right Grip	1.88	3.15	2.24	5.94	3.13	.32	1.97	9.29	—1.67	4.79	2.53	2.66	5.76
Left Grip	1.78	2.68	2.93	5.32	1.95	—2.20	1.30	7.78	—1.40	3.72	2.18	2.35	4.77
Back Force	1.17	1.55	3.06	3.54	2.58	.13	3.28	4.73	—1.75	4.27	2.75	2.18	5.35
Leg Force	2.04	3.56	5.64	5.04	3.39	.39	2.27	3.24	—2.20	4.95	4.25	2.40	6.51
Arm Pull	3.29	5.02	3.35	6.18	3.42	.49	2.58	6.51	—2.06	6.05	3.25	3.51	7.29
Arm Push	1.85	—.38	3.84	3.46	3.46	—.81	2.19	2.54	—5.39	5.06	1.89	1.87	5.67
Total Force	2.58	3.36	5.81	6.04	3.95	.45	3.23	4.86	—2.39	6.13	4.56	2.92	11.61
Physical Capicity Index	3.34	6.76	5.94	4.78	5.66	.57	4.33	2.98	—3.15	7.26	6.51	3.26	9.07
Number of cases	13	16	17	19	15	12	31	7	734	81	14	7	102

*A critical ratio of 2.00 is accepted in this study as indicative of a real difference. Such a ratio may be interpreted in terms of the normal probability curve as indicating 98 chances in 100 that the obtained difference is real, that is, greater than zero. A ratio greater than 2.00 denotes additional security. A negative ratio signifies that the normal group has the larger measurement.

**Exclusive of shot and discus events.

TABLE III

MAGNITUDE OF DIFFERENCES BETWEEN EACH ATHLETIC GROUP AND THE NORMAL GROUP IN STRUCTURAL AND FUNCTIONAL MEASUREMENTS*

	Baseball	Basketball	Football Backs	Football Line	Gymnastics	Tennis	Track and Field**	Shot and Discus	Non-Athletic Group	One-Sport Group	Two-Sport Group	Three-Sport Group	Total Athletic Group
Weight	.29	.81	.53	1.47	—.03	.17	.25	1.62	—.06	.39	.53	1.01	.45
Height	—.48	.80	—.03	.48	—.60	.23	.39	.75	—.03	.11	.29	.51	.17
Sitting Height	—.38	.52	.12	.57	—.10	—.05	.34	.49	.00	.05	.46	.47	.16
Shoulder Breadth	.17	.52	.17	.74	.21	—.14	.21	1.13	—.04	.21	.20	.86	.24
Chest Breadth	.30	.37	.56	.90	.19	—.27	.14	1.32	—.04	.28	.35	.66	.32
Chest Depth	.31	.66	.72	.92	—.18	.21	.29	.95	—.04	.25	.74	.83	.35
Hip Breadth	—.16	.45	.19	.76	—.52	.24	.09	.62	.00	.19	.16	.38	.18
Arm Girth	.56	.40	.57	1.27	.63	—.09	.05	1.27	—.06	.40	.62	.63	.43
Arm Span	—.44	.62	—.12	.38	—.27	.03	.41	.91	.00	.18	.10	.59	.20
Vertical Jump	.48	1.09	.64	.44	1.36	.11	.69	.43	—.07	.44	.95	1.03	.55
Right Grip	.40	.40	.33	.93	.52	.05	.25	1.94	—.06	.37	.50	.77	.41
Left Grip	.35	.44	.46	.80	.38	—.37	.17	1.72	—.05	.30	.43	.68	.35
Back Force	.20	.24	.52	.67	.52	.03	.41	1.53	—.06	.36	.59	.67	.41
Leg Force	.42	.55	.96	.92	.60	.08	.32	1.08	—.08	.42	.88	.76	.51
Arm Pull	.57	.63	.59	1.03	.67	.10	.32	1.74	—.07	.47	.66	1.06	.53
Arm Push	.29	—.06	.70	.69	.80	—.14	.32	.86	—.19	.44	.40	.69	.46
Total Force	.51	.47	.97	1.07	.75	.09	.42	1.52	—.09	.50	.93	.93	.64
Physical Capacity Index	.64	1.07	1.05	.92	1.19	.13	.56	1.06	—.11	.61	1.24	1.13	.71
Number of Cases	13	16	17	19	15	12	31	7	734	81	14	7	102

*The indices of significance may be interpreted as follows: from .00 ± .50 denotes a negligible or small difference; from ± .50 to ± 1.00 denotes a moderate or substantial difference; and from ± 1.00 and above denotes great to very great difference. A negative index of significance indicates that the normal group has the larger measurement while a positive index indicates a greater measurement for the athletic group.

**Exclusive of shot and discus events.

Football-Line.—Table II indicates that there are real differences between the successful football linemen and the normal group of students in all the test items of structure, strength, and power in favor of the linemen.

The largest of these differences, as shown in Table III, were found in weight and arm girth with indices of significance of 1.47 and 1.27 respectively, closely followed by those in total force and arm-pull strength with indices of 1.07 and 1.03. All these differences are of great magnitude. With the exception of arm span with an index of .38 and vertical jump with one of .44 all the remaining items disclose differences of moderate size. Height is considered as such although it yields an index of only .48. Other indices range from .67 to .93. The power tests, as shown by indices of .92 for P.C.I. and .44 for vertical jump, imply that while explosive power apparently is of importance to football linemen strength is of even greater importance.

These results disclose that, within this group, the individuals who tend to be successful college football linemen are those who, in comparison to the average individual, have much greater weight, arm girth, arm pull, and total force; and substantially greater height, sitting height, shoulder breadth, chest breadth, chest depth, hip breadth, right grip, left grip, back force, leg force, arm push, and P.C.I. In broad terms these individuals may be described as much heavier and stronger, and moderately more powerful and taller than the average student.

Gymnastics.—The gymnasts exhibit real differences from the normal group in five structural, six strength, and both power measurements. They are smaller in height, leg length, hip breadth, and arm span, and greater in arm girth, right grip, back force, leg force, arm pull, arm push, total force, vertical jump, and Physical Capacity Index.

Further inquiry by means of the index of significance technique, as shown in Table III, shows that with the exception of arm span, which has an index of –.27, all the above structural and strength differences have indices of moderate magnitude, while the power measurements have indices of great magnitude. Sitting height with an index of –.10 as compared to one of –.60 for height indicates that moderately short legs are characteristic of the gymnasts. (This is verified by an index of –.63 for leg length).

Within the limits of these basic data it may be said that the individual who tends to succeed in college gymnastics is one who, compared to the average individual, is patterned as follows: substantially smaller in height, leg length, and hip breadth; substantially larger and stronger in arm girth, right grip, back force, leg force, arm pull, arm push, and total force; and much greater in explosive

greater measurement for the athletic group.
**Exclusive of shot and discus events.

power. Gymnasts are an asymmetrical group of individuals with a very atypical structural and functional pattern arrangement. They may be described in general as moderately shorter, substantially more muscular and stronger, and much more powerful than the average college student.

These findings are substantiated in part by the results obtained by Schmidt and Kohlrausch[10] in their study of the body types of German athletes. They found gymnasts to be short, with broad shoulders, narrow hips, markedly developed arm and shoulder muscles, and comparatively light legs.

Tennis.—In respect to the structural and functional measures investigated in this study the tennis players appear to be normal in most traits. The critical ratio technique reveals real differences between the normal group and the tennis players in only two measurements. The latter have a weaker left grip (ratio $= -2.20$) and longer legs (ratio $= 2.65$).

Further investigation shows that these two measurements yield the largest indices of significance with –.37 for left grip and .42 for leg length. This indicates that all the measurements of the tennis players differ from those of the normal group to a low or negligible magnitude and implies that they contribute little of importance to the success of this group.

Within the range of this experiment these results indicate that tennis is a sport in which the average college student has an excellent opportunity to succeed. The investigator is of the opinion that while certain structural and functional traits, such as height and explosive power, undoubtedly contribute in some measure to better tennis performance, other factors not included in this experiment, possibly stroke technique and agility, may be the important discriminating elements in college tennis.

Track and Field.[11]—There are real differences between the successful track and field athletes and the normal group in five structural, five strength, and both power measurements. The athletes are greater in weight, height, sitting height, chest depth, arm span, back force, leg force, arm pull, arm push, total force, vertical jump, and P.C.I., as shown in Table II.

Of these differences the index of significance technique reveals that only the two power measurements are of at least moderate magnitude. Vertical jump has an index of .69 and P.C.I. an index of .56, as shown in Table III.

From these results it may be said that in respect to the factors of physique, muscular strength, and power included in this experiment, these track and field athletes as a group appear to be differ-

10 F. A. Schmidt, and W. Kohlrausch, *Physiology of Exercise*, pp. 197-198.
11 Exclusive of Shot and Discus throwers.

entiated from the normal group only by substantially greater explosive power.

Several experiments have revealed that a number of different body types may be associated with success in specific track and field sports. Others have found results to the contrary.[12] This study finds no structural type characteristic of track and field athletes as a group. If a variety of body types should be present within this group of athletes the results of this experiment indicate that when studied as a group they tend to neutralize one another.

Shot and Discus.—These athletes show real and positive differences from the normal group in all the structural and functional items measured except sitting height and vertical jump. The latter two measurements have critical ratios of 1.61 and 1.31 respectively which indicate that there are greater than ninety chances out of one hundred that the differences are real. This fact is important in view of their resultant indices of significance.

The indices of significance reveal, as noted in Table III, that structurally these shot and discus throwers are very much heavier than the normal group; much larger in shoulder breadth, chest breadth, and arm girth dimensions; and substantially larger in chest depth, hip breadth, arm span, height, sitting height, and leg length. (Leg length has an index of .69.) Sitting height with an index of .49 is accepted as a difference of moderate magnitude. In strength these athletes very greatly exceed the normal group in all the test items except leg force and arm push. The former item yields an index of great significance (1.08) and the latter has an index of .86, which is of substantial magnitude. The power tests yield interesting results. Vertical jump has an index of .43 which, though of low significance, is not so low that it can be ignored. P.C.I. with an index of 1.06 appears to be of great significance. Apparently the great power of these athletes is due much more to great strength than to explosiveness or speed in action.

In summary it may be said that, within the scope of the investigation and with this experimental group, the type or pattern of individual who tends to succeed as a shot or discus thrower is one who, compared to the average individual, is structurally: very much heavier, much larger in shoulder breadth, chest breadth, and arm girth; and substantially larger in height, sitting height, leg length, chest depth, hip breadth, and arm span; and functionally: very much stronger in right grip, left grip, back force, arm pull, and total force; much stronger in leg force; substantially stronger in arm push; and much more powerful as measured by the P.C.I. Shot and discus throwers might well be described in general terms as very heavy, big, and very strong individuals.

[12] See Chapter II, pp. 5-22 of the investigator's doctoral dissertation.

The results from the limited number of studies which are available on the subject are in close agreement with the findings of this research. Schmidt and Kohlrausch[13] pointed out that weight men are powerful and of massive build. McMurray stated[14] that weight, shoulder width, and chest breadth showed substantial correlations with shot-putting performance, while chest depth, hip width, and arm span also seemed to have some degree of association with performance in the event. He showed by multiple correlation technique that weight and shoulder breadth accounted for most of this relationship. McMurray also added that many of the experts overrated the importance of height to success in the event. This conclusion is verified by the data of this study.

One-Sport Group.—The One-Sport Group is composed of those athletes who are successful in only one sport, irrespective of the sport. This body of athletes shows real and positive differences from the normal group in all the structural, strength, and power measurements studied except height and sitting height, as shown in Table II.

Of these differences only total force and Physical Capacity Index have indices of significance of at least moderate magnitude. Their indices are .50 and .61 respectively. Several additional measurements reveal differences which tend to approximate moderate magnitude. They are arm pull, arm push, vertical jump, leg force, arm girth, and weight, with indices ranging in rank order from .47 to .39. It may be said, nevertheless, that of the factors investigated, only total force and P.C.I. differentiate this group of athletes from the normal group to any important degree and then only moderately. These athletes as a group are moderately stronger in total force and moderately more powerful, as measured by P.C.I., than the normal group of college students.

Two-Sport Group.—The Two-Sport Group is composed of those athletes who are successful in two sports, irrespective of the sports. This group shows real differences from the normal group in five structural measurements and in all the functional items except arm push, as shown in Table II. The structural differences are in weight, sitting height, chest breadth, chest depth, and arm girth. The athletes are larger in all the measurements indicated.

The index of significance technique reveals that there is a great difference between the P.C.I. of these athletes and the normal group as shown by an index of 1.24. Substantial differences are also found in all the remaining items in which real differences occur except sitting height, left grip, arm push, and chest breadth. The differences in vertical jump, total force, and leg force closely approach great magnitude.

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13 F. A. Schmidt, and W. Kohlrausch, *Physiology and Exercise*, pp. 197-198.
14 J. G. McMurray, *The Relation of Skeletal Symmetry to Athletic Prowess*, pp. 38-45.

In summary it may be said that, compared to the average student, the type of individual who tends to be successful in two college sports is one who has a much greater Physical Capacity Index: substantially greater vertical jump, total force, leg force, arm pull, back force, and right grip; and who is substantially heavier and larger in chest depth and arm girth.

Three-Sport Group.—The Three-Sport Group is composed of those athletes who are successful in three sports, irrespective of the sports. The athletes who are successful in three sports show positive and real differences from the normal group in all the structural and functional measurements investigated except sitting height and hip breadth. Arm push with a critical ratio of 1.87 is accepted as a real difference in view of its substantial index of significance (.69).

The index of significance formula discloses that these athletes show great differences in weight, arm pull, vertical jump, and P.C.I. Substantial differences are evident in all the other factors except sitting height and hip breadth. The latter two items seem to make some small contribution to the success of these men as implied by indices of .47 and .38.

It may be stated that within this group the type or pattern of individual who succeeds in three sports is much heavier, much stronger in arm pull, and has much greater explosive power than the average individual; he is also substantially larger and stronger in all the other factors investigated except sitting height and hip breadth.

Total Athletic Group.—The Total Athletic Group is composed of all the athletes measured, irrespective of sport. These athletes exhibit real, positive differences from the normal group in all the structural, strength, and power measurements investigated.

The indices of significance reveal that the differences in leg force, arm pull, total force, vertical jump and P.C.I. are substantial. Weight, arm girth, right grip, back force, and arm push with indices ranging between .41 and .46 apparently tend to make a small contribution to the success of athletes as a group. It may be said, nevertheless, that compared to the normal group of students, athletes as a group are substantially more powerful, and substantially stronger in leg force, arm pull, and total force.

Non-Athletic Group.—As may be noted in Table II the non-athletic group shows real differences from the normal group in leg force, arm pull, arm push, total force, and P.C.I. In all these measurements this group falls below the normal group. This would seem to imply that strength and power are more important to athletic success than bodily structure.

All of the above differences are of negligible magnitude, as shown in Table III. This indicates that conformity to a normal

pattern in the factors investigated is not conducive to success in athletics.

SUMMARY OF RESULTS

1. The reliability and objectivity of all the measures used in this investigation were found to be acceptably high.

2. Table IV gives a summary of the basic data. It shows the types or patterns of individuals who tend to succeed in various college sports and athletic groups. These are differentiated from the average student as follows:

a) Baseball: Substantially shorter; substantially greater arm girth, arm pull, total strength, and power.

b) Basketball: Much greater explosive power; substantially greater weight, height, sitting height, leg length, shoulder breadth, chest depth, arm span, arm pull, and leg strength.

c) Football—Backfield: Much greater P.C.I.; substantially greater weight, chest breadth, chest depth, arm girth, vertical jump, back force, leg force, arm pull, arm push, and total force.

d) Football—Line: Much greater weight, arm girth, arm pull, and total strength; substantially greater height, sitting height, shoulder breadth, chest breadth, chest depth, hip breadth, right grip, left grip, back force, leg force, arm push, and P.C.I.

e) Gymnastics: Much greater explosive power; substantially smaller in height, leg length, and hip breadth; substantially greater arm girth, right grip, back force, arm pull, arm push, and total force.

f) Tennis: No substantial differences.

g) Track and Field:[15] Substantially greater explosive power.

h) Shot and Discus: Very much greater weight, right grip, left grip, back force, arm pull, and total force; much greater shoulder breadth, chest breadth, arm girth, leg force, and P.C.I.; substantially greater height, sitting height, leg length, chest depth, hip breadth, arm span, and arm push.

i) One-Sport Group: Substantially greater total force and P.C.I.

j) Two-Sport Group: Much greater P.C.I.; substantially greater weight, chest depth, arm girth, vertical jump, right grip, back force, leg force, arm pull, and total force.

k) Three-Sport Group: Much greater weight, arm pull, and explosive power; substantially greater height, shoulder breadth, chest breadth, chest depth, arm girth, arm span, right grip, left grip, back force, leg force, arm push, and total force.

l) Total Athletic Group: Substantially greater leg force, arm pull, total force, and explosive power.

m) Non-Athletic Group: No substantial differences.

[15] Exclusive of shot and discus events.

3. The supplementary data, for the most part, suggest that the basic results may possibly have general application.[16]

CONCLUSIONS

1. Within its limits this investigation tends to substantiate the common claim that factors of body structure, muscular strength, and explosive power are associated with athletic success.

2. It also reveals that these factors are of varying importance to performance ability in different sports as is indicated by the tendency for each sport to have its own unique pattern of success.

3. Conformity to a normal pattern in these factors is non-conducive to success in athletics.

DISCUSSION AND RECOMMENDATIONS

As indicated previously one of the major purposes of measurement in physical education is the improvement of instruction through the medium of a better guidance program. Such a program should be both sufficiently scientific to discover the needs, the potentialities, and the interests of the individual and sufficiently elastic to provide opportunity for expression in suitable activity. Inasmuch as the results of this investigation reveal that, for the group studied, different sports tend to favor individuals who are uniquely patterned structurally and functionally; the study has educational significance in that it should help the physical director to guide individuals into activities in which they are more apt to find success and enjoyment. It should also afford the coach rough screening measures for his athletic squads.

While the supplementary data herein suggest in many instances that the findings may possibly have general application no such position may be taken until these results are verified and substantiated by those of similar investigations in a wide variety of educational institutions.

Comprehensive and detailed studies of a similar nature for a specific sport would be highly desirable. In such cases an attempt might be made to segregate the least number of factor traits essential for selective and guidance purposes.

It is also suggested that reservations be made in interpreting the results obtained in the combined athletic groups, e.g., the One-Sport Group, Two-Sport Group, Three-Sport Group, and Total Athletic Group. Hasty generalization will evidence loose thinking. From a different mode of attack, the results in these groups substantiate the general conclusions of the study that factors of structure, strength, and power are associated with athletic success and that different sports and athletic groups tend to have unique patterns of success. Nevertheless, it must be remembered that these

[16] Detailed evidence for the same may be obtained by referring to the author's doctoral dissertation mentioned above.

TABLE IV

SUMMARY OF RESULTS INDICATING THE MAGNITUDE OF DIFFERENCES BETWEEN EACH ATHLETIC GROUP AND THE NORMAL GROUP IN STRUCTURAL AND FUNCTIONAL MEASUREMENTS*

	Baseball	Basketball	Football Backs	Football Line	Gymnastics	Tennis	Track and Field**	Shot and Discus	One-Sport Group	Two-Sport Group	Three-Sport Group	Total Athletic Group	Non-Athletic Group
Weight		S	S	G				VG		S	G		
Height	—S	S		S	—S			S			S		
Sitting Height		S		S				S					
Leg Length		S			—S			S					
Shoulder Breadth		S		S				G			S		
Chest Breadth			S	S				G			S		
Chest Depth		S	S	S				S		S	S		
Hip Breadth				S	—S			S					
Arm Girth	S		S	G	S			G		S	S		
Arm Span		S						S			S		
Vertical Jump	S	G	S		G		S			S	G	S	
Right Grip				S	S			VG		S	S		
Left Grip				S				VG			S		
Back Force			S	S	S			VG		S	S		
Leg Force		S	S	S	S			G		S	S	S	
Arm Pull	S	S	S	G	S			VG		S	G	S	
Arm Push			S	S	S			S			S		
Total Force	S		S	G	S			VG	S	S	S	S	
Physical Capacity Index	S	G	G	S	G		S	G	S	G	G	S	
Number of Cases	13	16	17	19	15	12	31	7	81	14	7	102	734

*These differences are indicative of the extent to which the athletic groups are atypical. The combination of the differences presents what may be termed the pattern of success as revealed by these measurements. The table may be read as follows: S—substantial difference; G—great difference; VG—very great difference; blanks indicate negligible or small difference; a negative sign indicates that the normal group has the larger measurement.

**Exclusive of shot and discus events.

groups are composed of individuals who are successful in different sports and combinations of sports and who do have widely varying patterns. A proper guidance program will require a careful evaluation of all of these considerations.

As a guide to future research it is suggested that the arm-pull and arm-push tests precede the back and leg-lift measures. The latter tests are quite strenuous and where individuals are not highly motivated this seems to be reflected in arm-strength scores which are generally lower than would be expected. It is also possible that the arm strength measures might be improved by preliminary investigations such as those made on the leg-lift test by Everts and Hathaway[17] and by Carpenter.[18] Valuable information might also be obtained by the inclusion of a few added measurements such as thigh and calf girth and length and breadth of foot.

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negative sign indicates that
**Exclusive of shot and discus events.

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A Pentathlon Scoring Chart Based on 10,650 Cases

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INTRODUCTION

THE program of the Townsend Harris High School,* of the College of the City of New York, has been so devised as to insure that each student will be engaged in vigorous organic activity during the periods in the activity program of the Department of Health and Physical Education. Also, the activities have been so selected as to attempt to meet the needs of the physiological and psychological interests of the age group. Time-space facilities are additional factors limiting the program. It is hoped that the student will acquire an interest in activities that will continue over into adulthood and lead to a more worthy use of leisure time.

THE STUDENT BODY

Students are admitted to Townsend Harris by means of a double "scholastic" selective process. First, upon the recommendation of their school principal to be a candidate for the entrance examinations; and second, admission is based upon relative standing in the entrance examination.

The physical status of the student, as evidenced by means of the medical examination or strength test, will not keep a student out. If a candidate is physically capable of getting to and from school and meets the scholastic requirements, he is admitted as a student.

For the past three years, the incoming classes have been put through the Rogers Strength Test. The results indicated a poor physical status as evidenced by the small number attaining a P.F.I. score of 100 or above. The strength test is given only after the student has been given a thorough medical examination by the medical staff.

The mean age of the student body is lower than that of the average secondary school (3-year course of study), being approximately 15+ years of age at the time of graduation.

From the above, it may be concluded that the student body is

The data herein referred to were assembled by the members of the staff of the Department of Health and Physical Education, consisting of Messrs. E. V. Ferguson, Jr., I. Zasloff, J. Counsellor, L. J. Cahn, W. J. Olt, Jr., A. Jannella, H. Sveinbjornsson, and the writer, who was supervisor of the department. Dr. A. Sperling, of the City College, assisted in the tabulations.

* This school was discontinued Aug., 1942.

younger than average, above the average in scholastic status, and below average in physical ability.

THE PROBLEM

Before placing an incoming student into an activity area or unit, it is required that he be medically examined by the school physician to determine if he is physically fit for the required program.

Every semester thereafter, the student is required to take a classification test, known as the "pentathlon." Failure to do so, results in the score made last being used for classification in the following semester.

A tabulation of the scores made, over a period of thirteen semesters, has been tabulated and scoring charts formulated. A total of 10,650 scores in each of the five events has been secured.

The pentathlon serves a two-fold function: 1) as an event in the intramural athletic program; 2) as a means of classification.

THE EVENTS

A. SELECTION:

The events were selected on the basis of: a nation-wide survey of tests having greatest frequency; limitations of time, space, and facilities; program to be conducted.

B. RULES:

1. *Potato Race.*—3 blocks, to be run against time (70 yards).

2. *30-Second Basketball.*—First shot to be taken from the foul line, succeeding shots from any position on the floor. The object is to shoot as many baskets as possible in 30 seconds.

3. *Standing Broad Jump.*—A. A. U. Rules were used to govern. Two tries, the better try to count.

4. *20-Yard Dash.*—Against time.

5. *Pull Ups.*—From high horizontal bar, using over-hand grasp, start from a straight-arm hang and pull up body until chin is over bar. The legs must be kept straight and the body must not swing. After each pull up, return to straight arm hang.

C. RECORDING:

The card used for recording the scores is shown below. The printing on both sides of the card is the same and it can be used for eight semesters.

USING THE TEST AS AN EVENT IN THE INTRAMURAL PROGRAM

As the problem of this paper is to establish sound statistical scoring charts to be used in classification, only a brief description of the use of the pentathlon, as an event in the intramural athletic program, will be presented.

RULES

1. The contest is open to all officially registered students,

PENTATHLON

Name.....
(Print) (Last) (First)

Date								
Gym Class								
Spot No.								
Registered Section								
Age	Yrs.	Mos.	Yrs.	Mos.	Yrs.	Mos.	Yrs.	Mos.
Height		In.		In.		In.		In.
Weight		Lb.		Lb.		Lb.		Lb.

EVENTS	Record	Score	Record	Score	Record	Score	Record	Score
Potato Race								
30 Sec. Basketball Throw								
Standing Broad Jump								
20 Yard Dash								
Pull Ups								
TOTAL								
CLASSIFICATION								

unless excused from the regular gymnasium program for medical reasons.

2. The contest will be conducted during the regular class periods in the week of .....

3. Blanks will be issued, to all students who desire them, at the time of their regular gymnasium class.

4. Classification:

a) The contest will be conducted on the basis of the official school classes and the records compiled by each student will be credited to his official class.

b) All competitors will be classified according to weight, taken in gym costume, on the day of the competition. An individual may compete in only one weight division.

Division 1—110 lbs. and under
Division 2—125 lbs. and under
Division 3—Unlimited

c) The contest will be conducted in two school divisions. Students officially enrolled in the first-year classes will constitute one division of competition; and the balance of the classes, or upper school, will constitute the other division of competition.

5. Conduct of events:

a) Each contestant must compete in all five (5) events, the same period, in the order listed on the scoring sheet.

6. Scoring:

a) The scoring shall be on a point score basis and the scoring table will be posted on the gymnasium bulletin board.

b) The points scored by each individual will be compiled after the contest is closed. Each class should endeavor to have as large an entry as possible.

c) After scores are compiled, the scores of the fifteen (15) contestants who have the highest marks in each class are added together to obtain the class score.

d) In addition to the scores of the highest fifteen contestants in each class, points will be awarded equal to the percentage of the class that took part in the contest and completed all five events (i.e., if 85 per cent of the total class participates in the five events, 85 points will be added to the total scored by the fifteen high scorers in that class, and the grand total shall be the *Official Class Score*).

7. Awards, or winners:

The winners will be the five highest scorers in each weight division of the upper school, and the three highest scorers in each weight division of the lower school. The variation in the total of winners is made because of the difference in the total number of competitors in the lower and upper school, approximately 2 to 1 ratio.

SCORING CHART

As indicated previously, the scoring chart was formulated on an accumulated total of 10,650 cases in each of the five events.

To insure a total with values from 0 to 100 per cent, the formula $\frac{6 \times S.D.}{100}$ was used.

SCORING CHART

(Based on 10,650 ceses)

EVENTS

Per Cent	Potato Race (70 yards)	30 Sec. Basketball Goals	Standing Broad Jump (Inches)	Dash (Seconds-Tenths)	Pull Ups (Over Grasp)
100	12.5	17	108	2.7	13
99	12.6		107		
98	12.7		106	2.8	
97	12.8				
96	12.9	16	105		12
95	13.0				
94	13.1		104		
93	13.2		103	2.9	
92	13.3	15			
91	13.4		102		11
90	13.5		101		

Per Cent	Events				
	Potato Race (70 yards)	30 Sec. Basketball Goals	Standing Broad Jump (Inches)	Dash (Seconds-Tenths)	Pull Ups (Over Grasp)
89	13.6				
88	13.7		100	3.0	
87	13.8		99		
86	13.9	14			10
85	14.0		98		
84	14.1		97		
83	14.2			3.1	
82	14.3		96		9
81	14.4				
80	14.5	13	95		
79	14.6		94		
78	14.7			3.2	
77	14.8		93		
76	14.9	12	92		8
75	15.0				
74	15.1		91		
73	15.2		90	3.3	
72	15.3	11			
71	15.4		89		
70	15.5				7
69	15.6		88		
68	15.7		87	3.4	
67	15.8				
66	15.9	10	86		
65	16.0		85		
64	16.1				6
63	16.2		84	3.5	
62	16.3	9	83		
61	16.4				
60	16.5		82		5
59	16.6		81		
58	16.7			3.6	
57	16.8		80		
56	16.9	8	79		
55	17.0				
54	17.1		78		4
53	17.2			3.7	
52	17.3		77		
51	17.4		76		
50	17.5	7			
49	17.6		75		
48	17.7		74	3.8	3
47	17.8				
46	17.9	6	73		
45	18.0		72		
44	18.1		71		
43	18.2			3.9	
42	18.3	5	70		2
41	18.4				
40	18.5		69		
39	18.6		68		
38	18.7			4.0	1
37	18.8		67		
36	18.9	4			
35	19.0		66		
34	19.1		65		

Per Cent	Events				
	Potato Race (70 yards)	30 Sec. Basketball Goals	Standing Broad Jump (Inches)	Dash (Seconds-Tenths)	Pull Ups (Over Grasp)
33	19.2			4.1	
32	19.3		64		
31	19.4		63		
30	19.5	3			
29	19.6		62		
28	19.7			4.2	
27	19.8		61		
26	19.9	2	60		
25	20.0				
24	20.1		59		
23	20.2		58	4.3	
22	20.3	1			
21	20.4		57		
20	20.5				
19	20.6		56		
18	20.7		55	4.4	
17	20.8				
16	20.9		54		
15	21.0		53		
14	21.1				
13	21.2		52	4.5	
12	21.3		51		
11	21.4				
10	21.5		50		
9	21.6		49		
8	21.7			4.6	
7	21.8		48		
6	21.9				
5	22.0		47		
4	22.1		46		
3	22.2			4.7	
2	22.3		45		
1	22.4		44	4.8	
0	22.5	0	43	4.9	0
Frequency	10650	10650	10650	10650	10650
Mean	17.46	6.79	75.24	3.72	3.38
S. D. (σ)	1.61	3.34	10.71	0.31	3.03

A Study of the Present Status of Teacher Training in the Dance in the State of Utah

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FROM observing practice teachers in physical education, the writer realized a lack of ability in the students to teach dancing as compared with sports and games. Since dancing is included in the curriculum of most high schools, it becomes imperative for teacher-training institutions to adequately prepare graduates in physical education to meet the demands of the positions they are to fill. Therefore, the problem of determining the status of teacher training in the dance for teachers of high school girls' physical education was attacked.

An analysis of the physical education major course, and particularly the dance courses, in each teacher-training institution in Utah was made. The Utah State Agricultural College, the University of Utah, and The Brigham Young University are the institutions which offer a major in physical education and whose graduates can be certificated by the State Board of Education.

By means of a questionnaire, the demands made upon the teachers of girls' physical education were determined. The questionnaire was so constructed that the amount of class time spent in dancing and the club and program work for which the physical education teacher is responsible, were determined. Also, the deficiencies in the teacher's college preparatory work became apparent.

In order to authoritatively evaluate the dance training which physical education majors are receiving, a questionnaire was sent to authorities on dance education in the United States. From the returns a recommended course was set up as a measuring stick by means of which the courses now being taught could be criticized.

The findings, in general, are as follows:

From questionnaires sent to 145 high school teachers, 66 or 45.5 per cent were returned, and the following data are significant:

Number of majors in physical education reporting	48
Number of minors in physical education reporting	6
Number reporting neither major nor minor	12
Average number of hours per week spent in teaching health and physical education	23

* This article is an abstract of a thesis submitted by the author as part of the work for the Master's degree, June, 1942.

Per cent of class time spent on some type of rhythmic work	25.0%
Excluding health work, the per cent of activity time spent in rhythmic work	35.0%
Percentage of teachers handling dance clubs	34.8%
Percentage of teachers handling programs involving dancing	80.3%
Average number of students per class	37
Average amount of credit in dance earned by the teacher in her college work	12.5
Percentage of teachers who considered the undergraduate dance training adequate	10.6%
Percentage who considered their training inadequate	69.7%
Percentage who made no answer about their training	19.7%

Significant data from the teacher-training institutions being studied are as follows:

	US.A.C.	U. of U.	B.Y.U.
No. of quarter hours required for a major in phy. ed.	64	45	44–46
No. of hours in dance required	[illegible]	7	10
Additional hours in dance available	6	3	5
Practice teaching requirements	2 Qtrs. 60 minutes daily	2 Qtrs. 60 minutes daily	80 clock hours minimum

From the questionnaire which was sent to thirty-one authorities in the field, and 90 per cent of which were returned, the following items are notable:

1. A program is suggested which would require ten courses in dance education. through which a student could earn a maximum of 17 credit hours.
2. It is recommended that each activity course in dance should devote a portion of its time to methodology for teaching that particular type of dance.
3. A special methods course for teaching dance should be given.
4. Experience in working with all age levels should be provided.

The program of courses with the amount of time and credit recommended by the authorities is as follows:

Course	*Semesters* No.	Hours per wk.	Credit	*Quarters* No.	Hours per wk.	Credit
Introduction to Dancing	2	2	2	2–3	3	1
Folk and National Dancing	2	2	1–2	2–3	3	1
Social Dancing	1	2	1	1	2	1
Tap, Clog, Character Dance	1	2	1	1	3	1
Rhythm for Children	1	3	1–2	1	3	2
Modern Dance	2	2 or 5	1–2	3	3	1
Rhythmic Form and Analysis	1	2	1	1	3	1
Dance Composition	1	2	1	1	2–5	1–2
History of Dance*	1	2	2	1	1	3
Philosophy of Dance*	1	3	3	1	1–3–5	3

A complete outline of each course content was determined and is indicated in the complete thesis report. In addition to the courses

* This course content might be included with other courses if adequate time for a separate course is not available.

of dance which were recommended, the following objectives and related courses were also suggested:

Students contemplating a major should have:

1. A well developed sense of rhythm.
2. A genuine interest in and liking for physical education.
3. A genuine interest in and liking for people.
4. It is desirable that potential majors have a genuine interest in and liking for dancing.

Each student should achieve the following big objectives during her college training:

1. She should evidence an understanding of the principles and techniques of dancing.
2. She should have developed an exact, precise, and accurate rhythmic response.
3. She should grow in imaginative expression and creative ability.

It is important that the following professional objectives be reached by each student:

1. She should believe in the educational values to be achieved through dance.
2. She should have had experience with all forms of dance.
3. She should have a knowledge of acceptable sources of dance materials.
4. She should have developed an acceptable teaching methodology of dance.
5. She should have an understanding of the history of dance.
6. She should have the ability to create dance forms and to interpret dramatic ideas.
7. She should be equipped to teach all forms of dance.
8. It is desirable that she be able to play simple compositions on the piano.
9. It is desirable that she have a knowledge of elementary harmony.

The following related arts courses are recommended to be taken by each physical education major student: Art Appreciation, Speech for the Teacher, Music Appreciation, General Art, Stage Lighting and Design, History of Art, Music as Accompaniment are suggested as excellent courses if time permits their being pursued.

The following foundation courses are recommended: Biological Sciences—General Biology, Physiology, Human Anatomy, Physiology of Exercise, Personal Hygiene, Community Hygiene; Physical Sciences—Organic Chemistry, Physics; Social Sciences—General Psychology, Sociology, History, Philosophy, Educational Psychology.

It is suggested that the following courses might be pursued if time permits: Biological Chemistry, Zoology, Economics, and Ethics.

The following recommendations are cited in full from the complete thesis (pp. 110-113).

1. It is recommended that the Standard Course as presented in this study be used as a basis upon which curriculum revision and course content revision may be made.

2. It is recommended that a very careful selection of candidates for major students in physical education be made.

3. It is recommended that a course in "Methods of Teaching Dance to Junior and Senior High School Students" be added as well as a course for elementary dance.

4. It is recommended that, due to the lack of time, all major students need not be required to take all technique courses offered in modern dance, but that such course may be offered to meet the demand for cultural development of those students on the campus who desire such work.

5. It is recommended that a broad, basic course be offered to students in the field of secondary education who may have to teach dance and other physical education activities as well as their major subject.

A dance major with a minor in sports and games would more effectively prepare girls to teach dance. However, if such a major is not operative and a physical education major is offered, course content in dance will necessarily have to be combined to allow time for the other subjects which a student is required to pursue. The Standard Course as herein recommended would require ten dance courses occupying thirteen quarters with an average of three hours per week per class and would carry an aggregate of seventeen credit hours.

7. It is recommended that more opportunities to do practice teaching in dance be provided.

8. It is recommended that a practice teacher be supervised by the teacher in charge of dance education as well as by the critic teacher and supervisors from the Education Department of the College.

9. In line with the Standard Course it is recommended that a course in each of the following subjects be pursued to provide the student with an adequate background to teach physical education: Biological Sciences—General Biology, Physiology, Human Anatomy, Physiology of Exercise, Personal Hygiene, and Community Hygiene; Physical Sciences—Organic Chemistry, Physics; Social Sciences—General Psychology, Sociology, History, Philosophy, Educational Psychology.

10. In accordance with the Standard Course it is suggested that courses in biological chemistry, zoology, economics, and ethics are desirable as background courses if time permits.

11. It is recommended that at least one course in each of the following subjects be pursued to give the student a more adequate background in allied arts: Art Appreciation, Speech for the Teacher, Music Appreciation.

12. It is suggested that a course in each of the following subjects be pursued for additional cultural development if time in the college work permits: General Art, History of Art, Stage Lighting and Design, Musical Accompaniment.

13. It is recommended to the Utah State Agricultural College that the total number of hours required for a major in physical education be lowered to allow time for electives among related and allied courses of work. This might be done by combining courses of techniques in minor sports and methodology of teaching certain types of activities.

The teacher-training institutions of Utah are attempting to teach the skills of all currently popular sports as well as the various forms of dance to students majoring in physical education. They are attempting to prepare those same students to become teachers of physical education on the junior and senior high school levels. To accomplish both of these objectives is time consuming and expensive when considered from an administrative viewpoint. Several authorities answering questionnaires suggested that a five-year course or a major in dance alone might be the solution to the problem.

If students in elementary and secondary schools were better trained in dance and sports techniques, those students coming to college would be better prepared to handle the work leading to the teaching of physical education. Students majoring in mathematics, for instance, do not expect to take elementary arithmetic in college, but come ready to do work of college caliber. Similarly, when the standards of entrance requirements into the physical education department are such that the preliminary training of skills and techniques has been done, there will be sufficient time in the college course to adequately prepare students to become teachers of physical education.

Two First-Aid Examinations For College Students and Adult Groups

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THE writer is a special instructor in first aid for the American Red Cross. In the past two years he has prepared approximately one hundred and fifty men and women for the Instructor's Certificate. Many of these have taken up the task of teaching standard and advanced courses throughout the country. Some are teaching in new industrial centers, others are instructing in factories, a few are educating at army posts, and a large portion of the group are training groups within their own communities. Through a constant contact with these new teachers, the author discovered that one of their major problems was the creation of a test that would be adaptable to the many eager and educated defense workers. With this in mind an opportunity was sought to develop a test that would be easily administered, objective, reliable, and valid. This chance presented itself in the winter and spring of 1942. At this time, as part of a campaign conducted by the Brooklyn Chapter of the American Red Cross, which issued 76,086 First-Aid Certificates from July, 1941, to June, 1942, Brooklyn College offered many courses in Standard American Red Cross First Aid to students, faculty, administrative staffs, and the community generally. These courses were taught by members of the College Hygiene Department, all qualified instructors in American Red Cross First Aid, and a few, also certified teachers, who were not members of the college faculty.

In planning the work the problem of testing arose. The writer, who had much experience in composing such examinations, presented two tests, each consisting of seventy-six multiple choice questions. The tests were used by several instructors and the data analyzed. At first it was believed that the results might be useful to other health education teachers and might be publicized on this basis alone. This feeling was made stronger when, within the plan adopted by the U. S. Office of Education Wartime Commission on "Health and Physical Fitness In Colleges and Universities," as reported in the JOURNAL OF HEALTH AND PHYSICAL EDUCATION for October, 1942, one of the requirements noted is a course for every student in first aid as outlined by the American Red Cross. It appears now that these tests may have even more value in that they may be helpful in aiding some institutions in adopting this wartime

program. It is with such an idea in mind that the results in first-aid testing conducted at Brooklyn College are now presented.

THE TESTS AND QUESTIONNAIRES

Two tests were used. Each consisted of 76 four-choice multiple choice questions. The students were given time to finish the test. Most students finished within sixty minutes. A few took a little more than one hour. Each student was asked to fill out a questionnaire attached to each test in order to give the investigator data upon which to get some idea of the background of each group. Questions thought pertinent were asked. It was known that first aid was learned incidentally in other school work, that some had positions where they learned some first aid, and that many of the fundamental scientific truths taught in first aid are learned in other subjects. An evaluation on these bases was thought pertinent.

In addition it was thought that married people might have more opportunity to practice first aid about the home and that this might affect results. However, an insignificant number of the people were married and no comparison could be attempted. The groups were mixed. No attempt was made to distinguish on the basis of sex.

The two tests may be found at the end of the article. The correct answer for each question, according to the *First-Aid Textbook* is given.

DESCRIPTION OF THE COURSE

The content of the course was based entirely on the subject matter presented in the *First-Aid Textbook* of the American Red Cross which was used as a text. The information presented in ten classroom lectures and recitations of two hours each satisfied the requirements of the Standard Course.

Nine teachers, seven of whom were members of the staff of the Hygiene Department of Brooklyn College, taught the course. All of them were qualified teachers of American Red Cross First Aid. Each taught one to three courses. Fifteen courses were taught. The average number of students in each class who completed the work and took the test was twenty-six. The range was from fifteen to forty-two students.

The tests were approved by the department chairman and were mimeographed by the College. They were read by most members of the department and declared to be valid tests of the information to be asked. The seven departmental teachers, and two non-departmental teachers, who employed the examinations, declared they were valid before using them.

A further check on validity is the fact that all the material on the test was gathered from the course textbook. Nothing was used which was not in line with the material in the American Red Cross First-Aid Textbook.

Finally, an indirect check on the validity of the tests lies in the high index of reliability of both of these examinations. These indices will be shown presently.

THE STUDENTS

Four groups of students were employed in the test. There was the A group which, after being taught, took the A test. There was the C group which, without being taught, took the A test. There was a B group which, after being taught, took the B test. There was a D group which, without being taught, took the B test. The C group served as a control on the A group. The D group served as a control on the B group.

Were the groups comparable? All four groups were equivalent for this work from the point of view of Red Cross Standards. These required the student to be at least seventeen years of age or to have completed two terms of high school. On this basis C was a control on A and D a control on B.

Were they comparable in other respects? Yes. Using age as a criterion, A and C were equivalent. The A group averaged 21.34 years, the C group, 20.19 years. The difference was not statistically significant since $D/\sigma D^*$ equalled only 2.09. Similarly the average age for B was 21.17 years; for D, 19.9 years and the statistical difference, as represented by a $D/\sigma D$ of 1.67, was not significant.

But were there not other factors which might affect their grades on the test? Were they in first-aid courses on previous occasions? Had they been taught some first aid as parts of school subjects? Had they worked as counselors, as doctor's aides, or in stores where they had been permitted to practice some first aid? Had first aid been applied to them? Had they watched first aid applied to others? All of these factors might affect their learning in the course given them. To what extent? This was impossible to measure exactly. The intensity of the previous work, the amount of practice, the supervision over their prior work, the superficiality of previous learning, these and other elements would affect measurement of effectiveness and could not be traced. But that these experiences had aided learning at times and had hindered it at others, was apparent to the author from his experience in teaching many classes in first aid. Being unable to measure the exact effect of these experiences, the investigator believed it sufficient that it be shown that the amount of training that each group had was not overwhelmingly superior to that of any class of students with whom it was to be compared. The following tables show that each division of students had a fair amount of experience in first aid.

* $D/\sigma D$ is equal to the difference between the mean scores of the two groups compared divided by the standard error of the difference of the means. Where this ratio is 3 or greater it is certain that the difference between the two groups is significant; if it is less than 3 there is no significant difference.

TABLE I

PREVIOUS TRAINING AND EXPERIENCE IN FIRST AID OF THE SEVERAL GROUPS

(a) *Formal Training in First Aid*

Agency	Group A No.	Group A Per Cent	Group B No.	Group B Per Cent	Group C No.	Group C Per Cent	Group D No.	Group D Per Cent
Air Raid Warden	0	0	0	0	1	1.25	0	0
Boy Scout	9	3.87	5	3.35	1	1.25	1	2
Girl Scout	5	2.15	5	3.35	1	1.25	0	0
High School	3	1.29	2	1.34	0	0	0	0
Home Making	1	.43	2	1.34	0	0	0	0
Hygiene	1	.43	1	.67	0	0	0	0
Marine	0	0	0	0	1	1.25	0	0
Red Cross	7	3.01	4	2.68	1	1.25	2	4
Red Cross Ambulance	0	0	0	0	1	1.25	0	0
Water Safety	5	2.15	0	0	1	1.25	0	0
Totals	31	13.33	19	12.73	7	8.75	3	6

(b) *Experience*

Agency	Group A No.	Group A Per Cent	Group B No.	Group B Per Cent	Group C No.	Group C Per Cent	Group D No.	Group D Per Cent
Watched First Aid Performed	36	15.48	22	14.74	9	11.25	2	4
Received First Aid One or More Times	43	18.49	38	25.46	2	2.50	8	16
Worked as a First Aider	5	2.15	8	5.36	6	7.50	1	2
Some First Aid as Part of a School Course	32	13.76	20	13.40	33	41.25	7	14

Most of the first-aid cases watched were artificial respiration of drowned people. Most of those who worked as first aiders were counselors at camp or lifesavers. While the A and B groups were somewhat superior from the point of view of formal training in First Aid, the C and D groups were superior in that they had received a greater amount of incidental training. Finally, what was the nature of the formal school education of these groups? A glance at Table II reveals this picture.

It shows pretty clearly that more than 80 per cent of each group was made up of college students who might constitute the composition of any required college course where the particular year of one's college career during which the course had to be taken was not specified. It is in this respect that the study has value for the college program. It dealt with those college students that the U. S. Wartime Commission had in mind. This will be made especially clear, when in dealing with the test scores, it is shown that the presence of the adults who were not students did not affect the suitability of the tests for college groups. Aside from this the four groups were of a type that might be found in any Red Cross Standard Course among a population with a better than average education.

TABLE II
FORMAL EDUCATION OF SUBJECTS

Agency	Group A No.	Group A Per Cent	Group B No.	Group B Per Cent	Group C No.	Group C Per Cent	Group D No.	Group D Per Cent
Completed Elementary School	1	.433	5	3.333				
High School Education	5	2.170	12	8.000				
Some College Education			2	1.333				
College Students								
Freshmen	38	16.541	26	17.333	17	21.25	7	14
Sophomores	46	20.000	33	22.000	3	3.75	5	10
Juniors	50	21.738	32	21.333	17	21.25	21	42
Seniors	62	26.956	30	20.000	43	53.75	16	32
College Degrees	28	12.173	10	6.667			1	2
Totals	230	100.011	150	99.999	80	100.00	50	100

RELIABILITY OF TESTS

The reliabilities of the tests as determined by the Spearman-Brown split test formula were as follows:

Test A—.65
Test B—.84

The indices of reliability were:

Test A—.81
Test B—.94

These figures indicate the tests to be reliable. (See scattergrams for details.)

The average number of correct responses made on Test A by the A group was 58.35 or a mark of 76.77 per cent. The C group secured an average of 44.1 correct responses or a mark of 58.02 per cent. The statistical difference between the two groups is shown by a $D/\sigma D$ of 17.38 which is significant. It shows that the test does examine the student in the material taught.

The B group averaged 59.76 correct responses for a percentage grade of 78.63. The D group averaged 39.40 correct responses for a mark of 51.84 per cent. The $D/\sigma D$ between the two was 16.28 which is also significant.

How far did the presence of groups who were not college students affect these scores? In group A the people with degrees averaged 59.6 correct responses, the high school trained group 56.4 correct responses, and the elementary school-trained persons 58 correct responses. The average for the thirty-four students in this category was 59.08 correct responses, or a grade of 77.73 per cent, which is not significantly different from the mark made by the college students.

The college graduates of the D group averaged 61.1 correct responses, the high school trained people 52.8, and those trained

only through elementary school 49.4. The average of the group was 55.2 correct responses, or 72.64 per cent, somewhat lower than the average of the B group. The only effect this would have would be to indicate that the college students in the B group made an even higher grade than the average shows. The range of scores made by the several groups is shown in Table 3.

The passing mark required by the American Red Cross for the five items which make up its complete examination; i.e., artificial respiration, digital pressure, written examination, problem, and class work is 75 per cent. It specifies that at least 75 per cent must be made on artificial respiration and digital pressure. It leaves the

TABLE III
SCORES ON TESTS

Correct Responses	Percentage Value	*Test A* Group A	Group C	*Test B* Group B	Group D
75-76	99-100	0	0	0	0
70-74	92.4-97.68	1	0	7	0
65-69	85.8-91.08	20	0	26	0
60-64	79.2-84.48	70	0	40	0
55-59	72.5-77.78	90	2	41	1
50-54	66.0-71.28	35	16	20	6
45-49	59.4-64.68	8	18	8	2
40-44	52.8-58.08	5	21	4	14
35-39	46.7-51.48	1	14	2	16
30-34	39.6-44.48	0	6	2	6
25-30	33.0-38.28	0	3	0	5
	Totals	230	80	150	50

other passing grades at the discretion of the instructor. If the traditional 60 per cent is to be used as a passing grade on the examination, then both control groups were below that while both taught groups made a mark well above that. What should be a passing mark on this type of test is still to be settled.

DIFFICULTY OF QUESTIONS

In case a need is felt for using less difficult questions rather than more difficult ones there is presented below a list of questions in order of lack of difficulty (Table IV). The difficulty of these questions varies among college students and other educated groups because of backgrounds which include a study of the fundamental sciences upon which first aid is based. These questions may be varied to suit the group being taught.

CONCLUSIONS

It is recognized that the students in the investigation were not exactly alike in every detail. It was understood, however, that they met the Red Cross Standards for equivalence, and were statistically alike in age. It was also apparent that the groups were very similar and were typical of certain groups to whom Red Cross First Aid is taught. More especially, the results here appear applicable to

TABLE IV

ORDER OF LACK OF DIFFICULTY OF QUESTIONS

Test A			*Test B*		
Question Number	Percentage of Students Answering Correctly	Distance from Assumed 0 in Terms of σ	Question Number	Percentage of Students Answering Correctly	Distance from Assumed 0 in Terms of σ
22	99.57	0	18	99.33	0
1, 17, 26	98	.58	49, 76	99	.14
5, 9, 31, 33, 35	97	.75	56	98	.41
14	96	.88	1, 47, 67	97	.59
36, 47	95	.98	5	96	.71
13	94	1.07	10, 17	95	.82
25, 40, 42, 75	93	1.15	21, 30, 36, 43	94	.91
21	91	1.29	22, 27, 38, 39, 46, 70	93	.99
7, 8, 34	90	1.35	9	92	1.06
45, 59, 70	89	1.40	7, 8, 32, 51, 71	91	1.13
18, 19, 63	88	1.46	4, 42, 50, 63, 66	89	1.24
20	87	1.50	29, 74	88	1.30
10, 41	86	1.55	58, 72	87	1.34
3, 55, 65, 72	85	1.58	15	86	1.39
6, 15	84	1.63	19, 26, 62, 75	85	1.43
49, 61	83	1.68	69	83	1.52
39, 52, 56, 68	82	1.71	73	82	1.55
74	80	1.79	41, 65	81	1.59
12	79	1.82	28	80	1.63
66	75	1.96	12, 40	76	1.76
24, 53, 64	74	1.99	6, 14, 16, 45	75	1.80
38, 69	73	2.02	54	73	1.86
2, 27	72	2.05	13	72	1.89
32, 54	71	2.08	48	71	1.92
11	70	2.11	33, 60	70	1.95
16, 46	69	2.13	53	67	2.03
73	65	2.24	2, 52	66	2.06
28	61	2.35	64	62	2.16
51, 76	60	2.38	25	60	2.22
4	58	2.43	3	58	2.27
50	56	2.48	31	57	2.29
44, 71	54	2.53	20	56	2.32
57	53	2.55	68	54	2.37
23, 30	52	2.58	44	50	2.47
62, 67	48	2.68	34	49	2.49
58	43	2.81	11, 55, 59	44	2.62
48	39	2.91	57	41	2.70
29	38	2.94	23	36	2.83
60	35	3.02	61	32	2.94
43	29	3.18	24	30	2.99
37	25	3.30	35	16	3.46
			37	13	3.60

(σ in the above table is the symbol for standard deviation.)

groups of college students which is the major point of emphasis in this article.

It is believed that modifications of the examinations in accord-

TEST A

SCATTERGRAM FOR RELIABILITY COEFFICIENT

Incorrect Responses Odd-numbered	Even numbered 20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	fy
0																						0
1																						0
2													1	2								3
3										1	1		1			1	1	1				6
4									1		1		1					1				4
5							1	1			2	3	3	2	4	1						17
6						1	1	1	1		1	2	3	3	5	3		2				23
7				1	1	3	2	2	3	2	5	3	5	7	4	1	1	1				41
8							1	3	4	4	7	1	1	7	2	1						34
9					2	1	2	2	5	1	6	9	1	2		2						33
10							3	2	2		5	3	2	2	1		1					21
11						3	2		1	1	5	4	2		1	1						20
12							1		2	1	1	2	3									10
13			1		2				1					1	1							6
14					1		1						1									3
15				1	1			1														3
16			1	1				1							1							4
17						1																1
18																						0
19	1																					1
20																						
	1	0	2	3	7	9	14	13	20	10	34	27	27	26	19	10	3	5	0	0	0	230

Assumed mean of incorrect odd scores (y)—8.
σ of odd scores—2.36.
σ of even scores—3.31.
Number of cases—2.30
Sum of product of deviations from assumed mean—1010.

Product of corrections—.287.
Coefficient of correlation between odd and even scores—.486.
Coefficient of reliability of test—.653.
Index of reliability of test—.808.

TEST B

SCATTERGRAM FOR RELIABILITY QUOTIENT

Incorrect Responses Odd-numbered	Even numbered 25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	fy
0																											0
1																											0
2																						1			1		2
3																								2	1	2	5
4																	1	1									2
5																		2		3	1	2	1				9
6																					2	3	5	1			11
7														1	1	1		4	5	4	3	1	1	2			23
8													1		1			1	1	5			3				12
9														1	3	1	1	2	3	1		4	1				17
10															1	2	2	4	2	3		1					15
11												1		1	1	1		1	3	1							9
12														1		1		3	3		1						9
13											1				1	1	6	2	1								12
14								1				1		1	2				1	1							7
15													1	2	1												4
16											1							1		1			1				4
17								1		1			1														3
18													1														1
19	1				1			1																			3
20																											0
21															1												1
22																											0
23					1																						1
24																											0
25																											0
																											0
	1	0	0	0	2	0	0	3	0	1	2	2	4	7	12	7	10	21	19	19	7	12	12	5	2	2	150

Assumed mean of incorrect odd scores (y)—9.
σ of odd scores—3.96.
σ of even scores—4.05.
Number of cases—150.
Sum of product of deviations from assumed mean—1757.

Product of corrections—.173.
Coefficient of correlation between odd and even scores—.72.
Coefficient of reliability of test—.84.
Index of reliability of test—.94.

ance with the degree of difficulty of each question will prove a valid and reliable test for college students and adult groups.

Since there is no repetition of any question, combinations of several questions from each test may be used for an individual examination. In addition judicious choices of questions may serve as quizzes from time to time before the date of the final examination.

TEST A

Name .....

Address ..... Official class .....

(First-Aid Examination for American Red Cross Standard Certificate)

Insert in the parentheses the number preceding the word or phrase most accurately completing or best related to the statement. (Note: In this copy, correct answer is indicated in parenthesis.)

1. (4) First aid is (1) medical practice, (2) doing what you can with what you have, (3) immediate and complete care of the injured, (4) temporary aid to the injured prior to the services of a physician.

2. (1) First aid teaching trains a person (1) to prevent accidents, (2) to diagnose injuries, (3) to do nothing when a person is hurt, (4) to apply a tourniquet in each case of arterial bleeding.

3. (1) After an air raid when you appear on the scene of an accident where many outside house walls have been weakened and elevated structures undermined, the first thing to do is (1) transport victims, (2) keep back the crowd and permit the victim to lie where he is, (3) cover the patient with a blanket and give him an inhalant, (4) apply 2% tincture of iodine to patient's wounds.

4. (4) Give a stimulant in the following case: (1) apoplexy, (2) where the person is coughing frothy red blood, (3) where a person has received a severe blow on the head and one pupil of the eye is larger than the other, (4) where a person is unconscious and pale.

5. (2) On the scene of an accident (1) describe to the victim the nature of his injury, (2) cheer the victim, (3) permit onlookers to gather round and cheer the victim, (4) try to put the victim to sleep.

6. (3) Bones (1) give little support to the body, (2) afford fulcrum points for joints but do not serve as points for muscle attachment, (3) form cavities which hold vital organs, (4) heal more readily in adults than in children.

7. (4) The spinal column is (1) a stiff bone, (2) a series of vertebrae which make for an inflexible backbone, (3) a series of cartilaginous rings around a cylindrical bone reaching from head to pelvis, (4) a series of vertebrae interspersed with cartilage which makes for a flexibility which allows considerable movement and aids in breaking the shock of a fall.

8. (1) The number of ribs in the human body is (1) twenty-four, (2) thirty-three, (3) eight, (4) seven.

9. (2) The chest is (1) a solid bony formation in front of the body, (2) a cavity in which are found the lungs, the heart, the esophagus, and many large blood vessels, (3) separated from the back bone, (4) not part of the trunk.

10. (1) Which is true? (1) The collar bone is part of the shoulder girdle, (2) The knee cap is part of the thigh. (3) The wrist and ankle are solid single bones, (4) The upper and lower limbs consist of two bones with a point at the middle.

11. (1) Spasm of muscles in fracture is caused (1) by pain, (2) by loss of blood, (3) by traction splinting, (4) by tourniquets.

Assumed mean of incorrect odd scores (y)—9.
σ of odd scores—3.96.
σ of even scores—4.05.
Number of cases—150.
Sum of product of deviations from assumed mean—1757.
Coefficient of correlation between odd and even scores—.72.
Coefficient of reliability of test—.84.
Index of reliability of test—.94.

12. (1) In the human body it generally takes the blood the following length of time to clot (1) five minutes, (2) one hour, (3) one minute, (4) twenty minutes.

13. (2) The blood flows through the body from organ to organ as follows: (1) heart, lungs, head and arms, and back to heart, (2) heart, lungs, heart, arteries in all parts of the body, capillaries, veins, and back to heart, (3) heart, stomach where food is absorbed, lungs where oxygen is absorbed, blood vessels, and back to heart, (4) heart, lungs, head, arms and legs, stomach, and back to heart.

14. (1) In stopping arterial bleeding by digital pressure (1) apply pressure on an artery lying near a bone at a point between the heart and the wound, (2) apply pressure on the aorta, (3) apply cold packs on the heart and press, (4) press anywhere between the heart and the wound.

15. (2) Generally speaking, venous bleeding is stopped by use of (1) digital pressure, (2) direct pressure on the wound, (3) a tourniquet, (4) a transfusion.

16. (1) The number of respirations per minute in the adult human being is (1) 17, (2) 30, (3) 8, (4) 72.

17. (2) Nutrition of the body (1) takes place in the stomach, (2) is largely a result of digestion in the small intestine and absorption through the capillaries, (3) can be carried on without water, (4) can be carried on without oxidation.

18. (2) A dressing is (1) not a compress, (2) applied directly over a wound, (3) not used on burns, (4) not generally made of sterile material.

19. (4) The material to be applied directly to a wound is (1) adhesive tape, (2) collodion, (3) court plaster, (4) the inside of a freshly laundered, unsoiled handkerchief.

20. (3) In applying a compress (1) a sticky substance must first be placed near the wound, (2) it does not matter if the compress is in contact with the flesh nearby before it covers the wound, (3) one must be careful not to place it on the flesh around the wound before placing it on the wound, (4) iodine must be placed on the wound or burn first.

21. (1) In tying bandages use (1) a square knot, (2) a granny knot, (3) a bow, (4) a slip knot.

22. (1) Bandages used in first aid are (1) triangular, roller, and four-tailed, (2) four-tailed and court plaster, (3) rubber finger cots, cravat, and adhesive tape rolls, (4) collodion, roller bandages, and string.

23. (2) In applying a triangular bandage (1) to the whole head, the ends are brought under the chin and tied, (2) to the chest, the point is placed on the injured side, (3) to the shoulder, the point is rolled into the cravat on the uninjured side, (4) to the back of the head, each end is knotted separately.

24. (3) In using a cravat (1) on the eye, lay a strip of cloth over the injured eye first, (2) on the knee, apply the bandage with the leg kept straight, (3) on the ankle, bring the two ends across the back of the heel immediately after placing center of bandage under the foot, (4) on the ankle, remove the shoe first.

25. (4) A spiral reverse bandage is used (1) on joints, (2) on the nose, (3) for a dislocated jaw, (4) on the forearm or lower leg when an extensive part of either must be covered.

26. (4) A wound is (1) reddening of skin, (2) a bruise, (3) a break in a bone, (4) a break in the skin.

27. (1) The type of wound least liable to infection is the (1) incision, (2) abrasion, (3) laceration, (4) puncture.

28. (2) A characteristic of a laceration is (1) severe bleeding, (2) dirt

ground into the wound, (3) a deep hole in the flesh, (4) little destruction of tissues in the edges of the wound.

29. (3) The least danger of infection exists in the following case: (1) a finger-nail scratch, (2) a puncture, (3) a bruise, (4) an incision made with a sterile instrument.

30. (2) The procedure in wounds where bleeding is mild consists of the following series of aids in the order named: (1) clean away mechanical dirt with alcohol, apply iodine, let it dry, bandage, (2) clean away mechanical dirt with alcohol, apply a compress to stop bleeding, remove compress and paint with iodine, let iodine dry, apply a compress and secure with tape, (3) clean grease with benzene, apply iodine, apply triangular bandage, (4) apply iodine, let it dry, tape.

31. (4) Apply iodine in the following way: (1) pour it on the wound, (2) place injured member in a vessel of iodine, (3) soak the bandage with it, (4) swab it on with a bit of cotton on the end of a toothpick.

32. (1) In severe arterial bleeding the first thing to do is (1) to apply digital pressure, (2) to apply a tourniquet, (3) to elevate the part, (4) to pack the wound.

33. (2) The greatest danger in the use of the tourniquet is (1) blood poisoning, (2) gangrene, (3) shock, (4) too much initial bleeding.

34. (2) The American Red Cross recommends tourniquets where there is severe bleeding in the (1) head region, (2) lower arm, (3) groin, (4) chest.

35. (3) In a severe rupture of a varicose vein in the leg (1) give a stimulant, (2) do not cover the patient with a blanket, (3) lay the person down, elevate the part, and apply a direct compress, (4) pour iodine on the wound.

36. (2) The signs and symptoms of shock are (1) flushed face, rapid full pulse, and weakness, (2) pale face, weak rapid pulse, perspiration, and weakness, (3) strong rapid pulse, unconsciousness, dry skin, (4) pale, clammy skin, restlessness, and normal breathing.

37. (4) A person suffering from shock should be placed in the following position: (1) with head low in each case, (2) with head raised in case of fractured head or bleeding nose, (3) with head or legs raised, (4) sitting up when there is a chest injury.

38. (2) Severe bleeding differs from shock because of the presence of these additional signs and symptoms: (1) flushed face and full pulse, (2) anxiety, restlessness, and great thirst, (3) unequal size of pupils of eyes and limp arms, (4) weakness and unconsciousness.

39. (4) Complete treatment for powder burns: (1) first aid, (2) encouraging bleeding, (3) applying iodine, (4) encouraging bleeding, disinfecting, and giving tetanus antitoxin.

40. (4) When a chef falls while holding a large knife and lands with his stomach on the point of the knife so that his intestines protrude through the wound thus formed, the proper first aid is (1) to give a stimulant, (2) to keep the patient lying down and to apply iodine and gauze, (3) to push back the intestines and cover with warm saline solution, (4) to keep patient down and cover the wound with a warm saline compress.

41. (2) If after being bitten by a striped snake there is rapid swelling in the region and the signs and symptoms of shock appear (1) cut incisions at the wounds and bleed the patient, (2) tie a tourniquet just above the wounds, cut incisions near the bite wounds, and use suction to draw off blood at the points of incision, (3) capture the snake and have it examined to see if it is poisonous (4) use antivenin immediately.

42. (1) The sign of internal bleeding (1) in the stomach, is vomitus of a coffee-ground texture, (2) in the lungs, is vomitus of a tarry nature, (3) in

the intestines, is vomitus of a frothy red color, (4) in the heart, is feces of a tarry nature.

43. (4) To stop bleeding from the nose (1) place a gauze pack under the upper lip, (2) press the nostrils together firmly for thirty seconds, (3) have patient sit up with head thrown back and pack both nostrils tightly with absorbent cotton, (4) have the patient sit up with head thrown back and breathe through the mouth.

44. (3) The H-H inhalator is used (1) only occasionally in cases of carbon monoxide poisoning, (2) as a substitute for artificial respiration, (3) as an aid to be used at the same time with the Schafer method in carbon monoxide poisoning, (4) as an aid to be used at the same time with the Schafer method after a person begins to breathe about four times a minute.

45. (3) In the Schafer method of artificial respiration (1) the operator places the victim on his back, (2) the operator must straddle the victim's legs, (3) the operator places his palms on the small of the victim's back, small fingers along the lowest ribs, fingers in a natural position, and fingertips just out of sight, (4) the operator applies one-hundred-fifty pounds of pressure.

46. (2) In the Schafer method of artificial respiration the operator presses forward (1) twenty-one times a minute, (2) fourteen times a minute, (3) six times a minute, (4) half as many times as he sits back.

47. (1) Where there is a grating of bones, tenderness, deformity and pain in the leg after a person has fallen the injury most likely is (1) a fracture, (2) a sprain, (3) a strain, (4) an infection.

48. (2) Where a leg bone is protruding through the skin and there is arterial bleeding (1) apply a tourniquet loosely around the brachial artery, (2) stop bleeding with direct pressure and then apply a tourniquet, (3) do not use iodine on the wound, (4) use only non-traction splinting.

49. (3) Where a person has been hit in the head with a baseball and there is bleeding from the ears the first aider (1) gives the victim hot tea, (2) sits the patient up on a chair and carries him to a comforable place, (3) has the patient lie flat even in transportation, (4) does not apply ice packs to the head.

50. (1) When a workman who is hit on the jaw by a rock during a blast in a quarry has difficulty in swallowing water offered to him and experiences pain when he moves his jaw in an attempt to close it, the first aider (1) should raise the lower jaw until it is in contact with the upper one and apply a cheek cravat, (2) should set the bone, (3) should use a four-tailed bandage on the chin, (4) should do nothing.

51. (3) In case of a person having severe pain in breathing after suffering an automobile injury, the first aider (1) sits the patient up, (2) binds the patient's ribs after exhalation, (3) permits patient to lie still if a doctor is near the scene, (4) applies cold compresses to the rib.

52. (1) The order of procedures in traction splinting is (1) Mr. A draws the limb into normal position, Mr. B. slips on the traction splint, ties a traction hitch on the ankle or wrist, secures it over a notched end of the splint, draws it tight with a six-inch stick, then prevents the limb from sagging by means of a series of cradle hitches, (2) Mr. A. draws the limb into position and Mr. B. ties two boards on either side of the leg, (3) Mr. A. bends the foot at a right angle to the leg, Mr. B. ties a cravat bandage around the thigh, slips a notched board over the cravat, applies a traction hitch to the leg and ties it on the other end of the notched board, and then bandages the leg and board together, (4) Mr. A. pulls the limb into normal position and Mr. B. ties the other limb to it.

53. (3) Where a person falls, complains about pain at elbow, and keeps arm stiff, suspect a fracture and proceed by (1) putting the arm in a sling,

(2) putting the arm up in the same way that you would treat a fractured clavicle, (3) applying a single splint on the palm side of the arm, (4) applying heat to the arm.

54. (4) Before transporting a victim of a neck fracture (1) place him head up on a blanket, (2) straighten him out if he is in a crumpled position, roll him on his back, and place him on a stretcher, (3) if he is on his belly roll him over on his back as a unit and slide him on a stiff board to which he must be tied, (4) if he is on his belly, place a door beside him, and keeping head and body moving as a unit roll him over on to the door and tie him to it.

55. (3) Where an elderly person falls, has severe pain near the left hip and cannot lift his heel from the ground (1) put a right angle splint on the left foot, (2) place the left heel on a pillow before moving him, (3) apply traction to the left leg, place a long splint reaching from the left armpit to the left heel on the outside of the body, place newspaper between the legs, and tie the two legs and board together with seven cravats, (4) merely bend the knees and transport.

56. (2) Where the bones in the ankle seem to snap out of joint, go directly back, and the area begins to swell, the first aider (1) applies heat immediately, (2) places the ankle on a pile of books as the person lies down and applies towels wrung out in cold water, (3) massages the ankle, (4) turns the ankle inward and outward.

57. (1) A painter has fallen from a scaffold, cannot get up on his feet, has swollen, red legs and must be moved immediately because the scaffold above appears to be falling. The procedure is (1) to tie his legs together after placing a coat between them and use a six-man carry, (2) tear down a door, use as a splint, and use a fireman's carry, (3) insist on board splints and an ambulance before moving him, (4) roll him gently out of danger.

58. (1) During a match a wrestler suddenly rolls over and appears to be extending his right arm and complains of pain at the elbow which appears out of shape. The first aider (1) should tie the arm tightly to the body, (2) put the arm loosely in a sling and apply cold compresses at the point of injury, (3) keep him standing so that the arm will rest in a sling, (4) apply heat and massage immediately.

59. (4) In dealing with burns it is well to remember (1) that scalds must be handled only with dry materials, (2) that burns must be handled only with moist materials, (3) that greasy substances are the best medicines for all types of burns, (4) that the degree of the injury determines the first aid care.

60. (1) Tannic acid jelly is most useful in (1) a first-degree burn at the wrist, (2) a first-degree burn covering the entire chest and abdomen, (3) a deep electrical burn, (4) any third-degree burn.

61. (3) In applying ointments to burns over small areas (1) apply the grease directly to the burn with the fingers, (2) apply the salve with a cotton swab, (3) squeeze the salve out of the tube upon a gauze compress and then place this on the burn, (4) place the burned area in a vessel of ointment.

62. (3) Each of the following is true except (1) never apply iodine to a burn, (2) sunburn should be treated as any other burn depending upon its degree, (3) shock is severe even in minor burns, (4) baking soda solution, gentian violet jelly, and picric acid gauze are good burn remedies.

63. (3) Sunstroke is characterized by (1) a temperature of 107 degrees and a clammy body, (2) a rapid, weak pulse, temperature of 110 degrees, (3) a temperature of 105 degrees, a dry body, a flushed face and a full, rapid pulse, (4) consciousness, convulsions and pallor.

64. (1) The care for heat exhaustion includes (1) a stimulant, (2) ice bags, (3) placing victim with head elevated, (4) a tourniquet on the forehead.

65. (3) Where some of the water below the surface of the skin becomes frozen and therefore causes the area to turn grayish white the first aider (1) rubs the area with snow, (2) massages the area with grease, (3) places extra clothing over the area, (4) places a very hot pack over the area.

66. (3) In treating poisons taken by way of the mouth the American Red Cross advocates (1) dilution, (2) washing out, (3) filling the stomach with liquid and then inducing vomiting, (4) the use of antidotes immediately.

67. (3) Combat carbolic acid poisoning by (1) giving seven glasses of water into each of which a handful of epsom salts has been dropped, (2) giving two glasses of water into each of which a half handful of epsom salts has been dropped, (3) giving two glasses of water into each of which a half handful of epsom salts has been dropped plus four glasses of warm water, (4) giving a glassful of lye.

68. (2) To prevent tear gas poisoning the best method is (1) to have plenty of boric acid on hand, (2) to use a gas mask, (3) to use saline solution, (4) to use tap water.

69. (3) One must be accurate in determining whether a case of unconsciousness is due to either apoplexy, skull fracture, or drunkenness because (1) the treatment for apoplexy may cause the death of one with a fractured head, (2) ice packs used for drunkenness are prohibited in cases of skull fracture and apoplexy, (3) the forced movement in cases of drunkenness is dangerous in both skull fracture and apoplexy cases, (4) the stimulants used for a drunkard would seriously injure one with severe skull fracture though it might help an apoplectic.

70. (2) When a person becomes hysterical because of fear during an air raid (1) punch him in the jaw, (2) take him into a separate room and dash cold water in his face, (3) pull his eyelids and if there is no resistance, punch him in the jaw, (4) ridicule him with sharp sarcasm.

71. (2) Where a person collapses, (1) has a weak pulse and remains on the ground for some time, heart failure may be the cause and stimulants should not be used, (2) has severe pain around the heart and appears frightened, reassure the patient and give him black coffee, (3) has severe pain in the chest and cannot breathe, do not prop him up but keep him lying down, (4) and seems frightened, it is best to be frank in discussing his condition with him.

72. (3) A convulsion in a child is best cared for (1) by a cold bath, (2) by warm applications on the head, (3) by placing the child in a warm tub bath and applying a cold cloth on the head, (4) by giving immediately a quart of cod liver oil.

73. (4) Where there is pain in the ear (1) hot packs are not useful, (2) olive oil should be placed in the ear though there is no sign of a foreign body in it, (3) cold packs are useless, (4) a hot bag of salt or an ice bag may be used on the ear.

74. (3) In a common emergency characterized by (1) a toothache, one should scrape out the cavity with a clean knife and pack it with candle tallow, (2) an itchy rash after lying in the fields during an overnight hike, one should apply a combination of 95% phenol and 5% olive oil, (3) an infection on the eyelids, one should apply boric acid compresses, (4) a foreign body stuck in the nose, olive oil should be placed in each nostril and the nose violently blown with the unblocked nostril shut.

75. (4) The best means of transportation for a person with a fractured arm is (1) the fireman's carry, (2) the fireman's drag, (3) the packstrap carry, (4) the chair carry.

76. (1) Under ordinary circumstances (1) water, strips of cloth, and a knowledge of shock and artificial respiration are sufficient first-aid equipment, (2) antidotes, rubber tourniquets, roller bandages make the best medical kit, (3) iodine and bandages make up the best first-aid kit, (4) a scissors and a jar of unguentine are the only first-aid material one really needs.

TEST B

(First-Aid Examination for American Red Cross Standard Certificate)

Insert in the parentheses the number preceding the word or phrase most accurately completing or best related to the statement. (Note: In this copy correct answer is indicated in parenthesis.)

1. (3) The great need for first aid lies in the fact that (1) there has been an increase in the number of automobiles from 32,000 in 1904 to 32 million in 1940, (2) there are not sufficient doctors in rural areas, (3) there were at least nine million accidental injuries in the home, on the road, on the job, and on the public scene in 1940, (4) most injured people bleed to death.

2. (1) Upon arriving at the scene of an accident the first thing to do is to (1) survey the situation, (2) stop serious bleeding, (3) apply artificial respiration, (4) give antidotes for poisoning.

3. (4) Where a person is bleeding severely from the arm, has a weak pulse, and looks pale (1) give hot tea, (2) give an ammonia inhalant, (3) apply digital pressure at the carotid artery, (4) apply a compress directly on the wound.

4. (4) When taking command at a scene of an accident the first aider (1) sends immediately for a doctor, (2) does not send for a doctor, (3) calls for a doctor at a convenient time, (4) sends for a doctor at a suitable moment and forwards the location of the injured person, the extent of the injury, and the first aid being applied.

5. (3) When a person is injured (1) notify relatives, (2) notify friends, (3) notify immediate family, (4) notify no one.

6. (2) When the brain is severely bruised due to a fall (1) unconsciousness occurs only if shock is present, (2) swelling causes pressure against the cranium and causes unconsciousness, (3) the condition is known as a depressed fracture, (4) the condition is known as a simple fracture.

7. (1) The breast bone (1) serves as a support of the ribs, (2) is an extension from the back bone, (3) is the shoulder girdle, (4) is very flexible.

8. (3) The pelvis (1) supports the breast bone, (2) does not support the vertebrae, (3) when broken, frequently causes injury to the urinary bladder, (4) exists only in the human female.

9. (2) The abdominal cavity (1) is entirely below the ribs, (2) is separated from the chest by the diaphragm, (3) is filled entirely by the stomach, (4) is a digestive organ.

10. (3) A joint is (1) a connection between muscle and bone, (2) a connection between tendon and ligament, (3) a connection between bone and bone, (4) a connection between muscle and muscle.

11. (3) Which is true? (1) There are five to ten quarts of blood in the body. (2) the loss of three pints of blood is fatal. (3) There are six quarts of blood in the body, (4) Venous blood is useless.

12. (4) Generally speaking, human blood consists of (1) plasma, (2) red and white corpuscles, (3) red plasma and white corpuscles which protect against infection, (4) serum, red corpuscles, and white corpuscles.

13. (3) Which is true? (1) Blood from the arteries flows evenly and profusely, (2) Blood from veins spurts, (3) Blood from capillaries oozes, (4) External bleeding from a bruise is slight.

14. (4) Which is true? (1) the facial artery is situated in the neck,

(2) Press behind the collar bone and against the ribs to stop severe arterial bleeding in the neck, (3) The artery supplying blood to the thigh lies alongside the windpipe just below the jaw, (4) the temporal artery supplies blood to the forehead.

15. (2) Respiration is (1) the passage of carbon dioxide from the outside air through the windpipe, (2) an exchange of gases in the lungs whereby oxygen is absorbed into the blood and carbon dioxide liberated from the blood, (3) the passage of oxygen into the lungs, (4) blood warming.

16. (2) The respiratory action takes place in the following manner: (1) respiratory center is stimulated by oxygen and the lungs expand and contract, (2) respiratory center is stimulated by carbon dioxide which causes the ribs to be elevated and the diaphragm to be contracted thus permitting expansion of lungs, (3) suction valves in the nose draw in air, (4) the lungs create oxygen by oxidation.

17. (3) Nerve centers (1) carry only sensation of pain, (2) transmit impulses of light but not heat, (3) transmit all kinds of impulses to which human beings react and cause motor activities, (4) exist only in the brain.

18. (4) The best type of compress is made of (1) cotton, (2) very heavy cloth, (3) improvised material, (4) sterilized gauze.

19. (1) One may improvise a dressing by (1) scorching a bit of cloth with a hot iron, (2) holding a handkerchief over a gas flame provided the carbon is removed with the fingers, (3) placing cold gray ashes on a cloth, (4) washing a handkerchief in soap and water.

20. (3) Bandages are (1) applied directly over wounds, (2) used only to hold compresses in place, (3) used to keep splints in place and as slings, (4) not used to control bleeding.

21. (3) In using a bandage one should (1) wet it whenever possible, (2) tie it very tight to prevent swelling and gangrene, (3) tie it firmly, (4) tie it quite loosely to prevent swelling and gangrene.

22. (2) The names given to the parts of a trianglular bandage are (1) the corners and sides, (2) the point, ends, and base, (3) the spiral and the reverse, (4) the hem, the ends, and the tails.

23. (1) In applying a triangular bandage (1) to the thigh, no second bandage is needed, (2) as a sling, the point is placed on the shoulder corresponding to the side of the injured arm, (3) to the hand, one end is placed at the elbow and the other at the finger tips, (4) as a sling, each tail is always placed over a shoulder.

24. (1) For a fractured jaw the best bandage is (1) a cheek cravat, (2) a four-tailed bandage, (3) a triangular face bandage, (4) adhesive tape strips.

25. (3) Figure-of-eight bandages are most useful in covering (1) the chest, (2) the forearm, (3) the ankle, (4) the lower leg.

26. (2) A mat burn is (1) a blistered area, (2) an abrasion, (3) an incision, (4) a laceration.

27. (1) The type of wound characterized by a clean cut across the blood vessels is (1) the incision, (2) the laceration, (3) the bruise, (4) the abrasion.

28. (2) Wounds subject a human being primarily to the following dangers: (1) shock and metal poisoning, (2) infection and hemorrhage, (3) infection and gangrene, (4) nervous strain and weakness due to loss of blood.

29. (4) The most important factor in preventing germs from infecting a human being is (1) a high resistance, (2) weak germs, (3) a small number of germs, (4) an unbroken skin and mucous membrance.

30. (1) The percentage of iodine in alcohol to be used in first aid is (1) 2%, (2) 7%, (3) 12%, (4) 1%.

31. (1) The first thing to do in severe bleeding cases is (1) to apply pres-

sure to the wound itself, (2) to apply a tourniquet, (3) to elevate the part, (4) to apply iodine.

32. (1) One way to stop arterial bleeding of the forearm and at the same time walk alongside the victim is (1) by locking one's arm about the upper part of the victim's wounded arm, (2) by tying a tourniquet about the aorta, (3) by tying ice packs on the subclavian artery, (4) by tying a tourniquet at the wrist.

33. (4) A tourniquet should be loosened once every (1) ten minutes, (2) thirty-five minutes, (3) hour, (4) eighteen minutes.

34. (3) Digital pressure is recommended in (1) capillary bleeding, (2) slight arterial bleeding, (3) severe venous bleeding, (4) internal bleeding.

35. (4) Shock (1) never causes death, (2) results from fear, and infrequently from injury, (3) is a depression of the bodily system due to a stagnation of the blood in the coronary blood vessels, (4) causes the heart to beat rapidly.

36. (1) In order of importance the procedures used to prevent or eliminate shock are (1) warmth, position, stimulants, (2) stimulants, position, warmth, (3) position, stimulants, warmth, (4) warmth, stimulants, position.

37. (2) With respect to the use of stimulants the following rule should be kept in mind: (1) no stimulants in cases of unconsciousness or severe bleeding, (2) no stimulant in cases where a person is stabbed or has a bullet wound, (3) only warm tea or coffee should be used, (4) whiskey is the best stimulant.

38. (2) The danger of a punctured wound lies in the fact that (1) this type of wound is deep and receives no air and thus the flesh may die for lack of oxygen, (2) tetanus germs thrive where there is little air, (3) when iodine is placed in these deep wounds it cannot evaporate readily and causes burns, (4) they are the same as any other wound.

39. (3) When a wound is associated with red streaks radiating from the wound, swelling, pain, tenderness, heat, and pus, first aid consists of (1) lancing the area, (2) squeezing out the pus, (3) placing applications of hot epsom salts on the wound, (4) placing warm applications on the wound and compressing tightly with a cravat.

40. (3) If a person is bitten in the face by a dog (1) wash the wound with water and shoot the dog through the head, (2) paint with iodine, cover with gauze, and capture the dog, (3) wash with water from a tap, disinfect, and submit immediately to the Pasteur treatment, (4) squeeze to encourage bleeding.

41. (2) In removing a foreign body (1) from the eye, wash with boric acid, open eye and clean with a cotton swab, and remove an imbedded splinter with a forceps, (2) from under the nail, cut away a part of the nail and remove with a pincers, (3) from the eye, when the material is chemical in nature, by washing with streams of mild acids, (4) from the throat, by use of a long probe.

42. (3) When a first aider notes that the victim of an auto accident is extremely thirsty, anxious, and vomiting red frothy blood, the first aid he applies consists of (1) giving the person a stimulant, (2) commiserating with the victim, (3) keeping the patient flat on his back, (4) giving a blood transfusion.

43. (2) Where a bullet enters the upper arm, causes a break in the bone and a wound from the skin to the break in the bone the injury is called (1) a simple fracture, (2) a compound fracture, (3) a punctured wound, (4) a broken shoulder girdle.

44. (1) Artificial respiration (1) is successful because circulation does not stop immediately after breathing is discontinued, (2) by the Schafer method stresses inducement of breathing through elevation and lowering of

ribs, (3) is useless in cases of hanging and burial in debris, (4) is not necessary when an H-H inhalator is used.

45. (4) A person generally is beyond the aid of the Schafer method (1) when he collapses after stepping out of an automobile and his body turns cherry red in color, (2) when he is removed from beneath the surface of a lake and is blue and cold, (3) when an electric linesman collapses and is found with his body stiff and burns on his hands, (4) when brought in from beneath the surface of a lake and his body is stiff.

46. (1) In the Schafer method of artificial respiration (1) the most important supportive measure is warmth, (2) as soon as the patient begins to gasp permit him to sit up to make breathing easier, (3) a brief return of breathing means the patient is certainly safe, (4) beer is recommended as a stimulant.

47. (2) Where a fracture occurs (1) move the patient immediately, (2) attempt to prevent further damage, make the patient comfortable, and treat for shock, (3) set the bone, (4) apply traction for twenty minutes at a time and release for one minute.

48. (4) Traction splinting is used (1) only in simple fractures, (2) only in compound fractures, (3) in any fracture of the leg or arm, (4) in any fracture of the arm from the shoulder down to the wrist and of the leg from the hip down to the ankle.

49. (3) Where after a boxing bout an athlete is discovered with a deformed nose which is bleeding on the surface the first aider (1) straightens the nose, (2) tapes the nose, (3) applies a four-tailed bandage over a sterile compress, (4) puts a splint on the nose before taking the victim to the doctor.

50. (2) Where a person falls down a flight of stairs and suffers extreme pain in the left shoulder girdle and inability to raise the left arm, the first aider should (1) begin to look for splints, (2) pin the victim's left sleeve to his shirt and secure the left arm to his body with a tie, (3) put the arm in a narrow sling, (4) splash water in the victim's face to prevent hysteria.

51. (1) Traction splinting (1) means the drawing of an arm into normal position and fixing it there by means of a Murray-Jones splint or a wooden board with notched ends, (2) requires only one person, (3) is used successfully in compound fractures of the wrist and ankle, (4) requires too much strength for women to apply successfully.

52. (4) Non-traction splints (1) must extend beyond the joint above the bone which is injured, (2) must be padded wih gauze and cotton, (3) must be made of wood or corrugated board, (4) must extend beyond the joints on both ends of the broken bone.

53. (3) Which is true? (1) Movement is not possible when a forearm or lower leg is fractured. (2) Where there is crepitus and swelling in the wrist tie splints on the palm and back of the hand but do not put in a sling. (3) In a fracture of the hand place a splint on the palm side with the palm down, raise the fingers four inches above the elbow and put the arm in a sling. (4) In a fracture of the finger, draw the finger into place, thus setting the bone, splint, and put on an open-hand bandage.

54. (2) Where, after an auto accident, a person is found lying on his stomach and is unable to move his legs though he can move his fingers and he must be transported (1) roll him over on a stiff board, (2) slide him, head and body moving as a single unit, on a blanket, (3) pick him up in a three-man carry, (4) tie a series of cravat bandages about his trunk.

55. (3) A person who has been hurt in an auto accident is seen to have swelling and severe cuts about the right knee and is unable to raise the leg from the floor but must be moved. Proper first aid: (1) slip a pillow under the hollow of the knee, (2) slip a tourniquet loosely about the right thigh and

move in a chair carry, (3) slip a tourniquet loosely about the right thigh, place a pillow under the hollow of the knee, tie it on, lift in a three-man carry and transport, (4) put a stiff board under the leg, secure it with tape covering the leg across the knee, and put on a stretcher.

56. (4) When bones slip out of joint and remain that way the injury is called a (1) bruise, (2) sprain, (3) simple joint fracture, (4) dislocation.

57. (4) The first aider does not apply traction to replace a dislocation of the (1) lower jaw, (2) finger, (3) toe, (4) second joint of the thumb.

58. (1) A person bends over to lift a heavy bundle and suddenly feels great pain in the back and a few hours later suffers from a stiff neck. The aid consists of (1) laying victim down and applying a heat pad to the neck, (2) rubbing on a very hot liniment, (3) bending and twisting many times, (4) applying ice bags.

59. (2) A person lies out in the sun for a long time and suddenly feels severe soreness and pain on the neck and shoulders where there is much reddening of the skin and some blistering. This person is suffering from the following degree of burn: (1) first, (2) second, (3) third, (4) first and second.

60. (1) The proper aid to be applied in a third degree burn on the arm is (1) 5% tannic acid solution on a compress, (2) stimulants, (3) carbolic acid disinfectant, (4) tannic acid jelly.

61. (3) The first duty of a first aider in caring for a burn is (1) to treat for shock, (2) to disinfect, (3) to eliminate pain by covering the area with sterile gauze, (4) to look for a chemical antidote.

62. (4) If a student receives a spattering of hydrochloric acid (1) in the eye, sodium hydroxide must be syringed into the eye, (2) on the leg, all clothing including a garter buckle which is stuck to the burn must be removed, (3) in the eye, water must not be used, (4) in the eye or on the leg, large quantities of water should be applied.

63. (2) Heat exhaustion is characterized by (1) a clammy body and deep breathing, (2) a clammy, cold body, a weak pulse, consciousness, and a low temperature, (3) a lack of vomitus, a staggering gait, and a full pulse, (4) cramps in the muscles, a temperature of 110 degrees, a dry body, and unconsciousness.

64. (4) Care for heat stroke includes (1) salt tablets, (2) warm blankets, (3) placing patient with head low, (4) cold applications.

65. (3) Where a skier becomes numb, drowsy, and begins to stagger (1) he should be carried immediately to a place of shelter no matter how far that abode may be, (2) he should be wrapped in blankets and forced to lie down, (3) extra clothing should be put on him and stimulants given to him until transportation arrives, (4) artificial respiration must be started at once.

66. (2) To combat a poison taken by way of the mouth (1) give a glass of warm water, (2) give seven glasses of dish water and tickle the back of the throat, (3) give a strong stimulant in any case, (4) permit the person to sleep quietly.

67. (1) In cases (1) where corrosive poisons are taken, give milk after inducing vomiting, (2) where opium has been taken, let the person sleep as deeply as possible, (3) where morphine has been taken, give large doses of whiskey or get an H-H inhalator, (4) where an overdose of strychnine is used give black coffee.

68. (2) Where the gas used by an enemy smells like new-mown hay those poisoned should be (1) given artificial respiration, (2) forced to rest, (3) given no stimulants, (4) given work at the scene of the disaster so that they may not dwell upon their misfortune.

69. (4) Where a person sees an accident and faints (1) it is caused by a rush of blood to the head which causes pressure of the brain against the skull,

(2) the patient gets dizzy, sees black spots but does not become unconscious, (3) the pulse is weak and slow and the patient should be given black coffee to stimulate circulation, (4) he should be put in a sitting position with the head lower than the heart.

70. (1) Where a patient becomes unconscious and (1) shows a red face and strong pulse, apply cold applications to the head after putting the victim in a lying position with head raised, (2) shows a red face, give cold stimulants, (3) shows a pale face and weak pulse, give stimulants by way of the mouth, (4) turns blue, give him up for dead.

71. (2) Unusual conditions of the body which can be identified as (1) boils should be squeezed to extract the pus, (2) blisters should be punctured with a sterilized needle and then treated as wounds, (3) colds should be treated by home remedies, (4) pains in the groin resulting from lifting weights should be cared for by heavy exercise.

72. (4) A corn (1) should be cut off, (2) should be scraped off gradually, (3) should be covered with adhesive tape, (4) should be padded with lamb's wool and proper shoes worn.

73. (1) Where a person has been exposed to plants of unknown nature (1) one should scrub the body with strong soap and water, (2) one should apply calamine lotion, (3) one should cover the body with olive oil, (4) one should apply unguentine.

74. (4) Insect bites (1) should be lanced and exposed to the purifying process of the air, (2) should be covered with a compress of strong hydrochloric acid, (3) should be treated in each case by placing the person in a tub of hot water, (4) should be covered with a cold compress of water or baking soda paste.

75. (3) On a long hike in the woods where a person falls and severely injures his legs and arms the best means of transportation if there is a considerable distance to go is (1) the eight-man carry, (2) the fore-and-aft carry, (3) a litter made of two coats and two stout tree branches, (4) alternating fireman's and fore-and-aft carries.

76. (4) A good minimum-sized, automobile first-aid kit contains (1) several sizes of compress, two triangular bandages, a jar of boric acid solution, (2) an H-H inhalator, paper cups, ammonia ampoules, iodine, triangular and roller bandages, (3) talcum powder, pincers, pulmotor, pliers, ten yards of unbleached muslin, (4) compresses, triangular bandages, iodine ampoules, six-inch stick, tannic acid jelly, a roll of one-inch bandage, and a jar of boric acid solution.

BOOK REVIEWS

INFANT AND CHILD IN THE CULTURE OF TODAY. Arnold Gesell, Frances L. Ilg, Janet Learned, and Louise B. Ames. (New York: Harper & Brothers, 1943) 399 pages, $4.00.

The systematic research work and study of actual children in the Yale Clinic of Child Development, which made this book possible, covered the first five years of life. Twelve age periods are separately treated. If an infant is now four weeks old and one wishes to compare how he actually acts with how most babies at four weeks behave, one simply turns to pages 98 and 99 for the answers. If he is forty weeks old, three and a half or four years old, or anywhere in between these ages, the index in the back will tell at once where to find out how he may be expected to behave.

Is there, then, a single pattern of development and behavior which fits all babies at a given age? The answer, of course, is "no". But years of observation carried on by the authors of this book have proved to them that the deviations of the average, healthy baby from a general classification of expectations are not, in terms of time, as marked as they may seem to some parents. Certain stages are bound to occur within a leeway of a really few weeks. For instance, most babies are able to grasp and hold on to a rattle at a certain age. Some do so earlier, some a little later. But the time that the majority achieve this accomplishment is given by the authors as the average age.

That is not all, however. These doctors tell us "why" and "how" as well as "when." They take readers behind the scenes in babyland and show the way that an infant's mind as well as body develops. They also help teachers and students decide when to encourage and when to expect cooperation on the part of the baby and how best to win it. Child guidance through the first five crucial years is of such infinite importance, that this book will be a great help to all those who are working with children under five years old and want to give them the best possible start in life. The style of writing is simple; the groupings clear cut; the summaries at each chapter's end are concise, and the index is complete. In the appendix is to be found very valuable material which could be used by any other organization preparing to carry on a similar type of research work in connection with a school or college.

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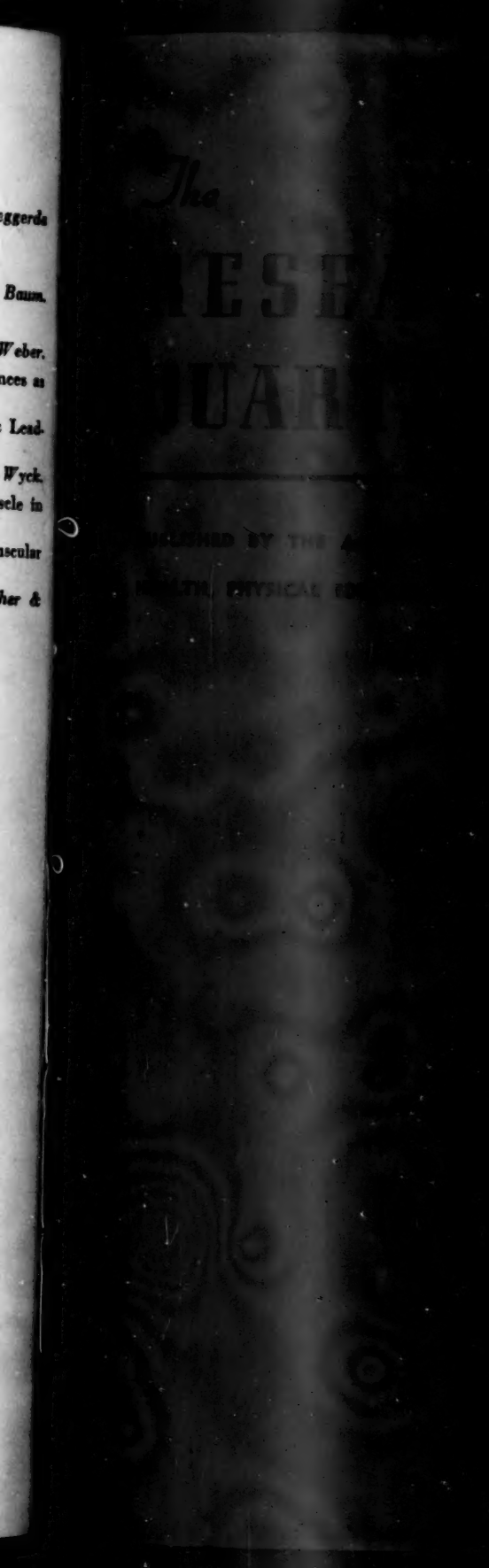
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